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Mr. Dunne's Serial Universe

By Dr. A. S. Russell

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Notes of the Month.

The Exhibition of British Art in Industry was opened at Burlington House by H.R.H. the Prince of Wales on January 4th, when a speech of welcome was delivered by Sir William Llewellyn, P.R.A., who commented on the unusual nature of such an exhibition within the precincts of the Royal Academy of Arts. The scheme of the exhibition is an entirely patriotic one, especially appropriate in this auspicious Jubilee year; it is to be hoped that it will attain its main objects, the betterment of the style of British products, and the consequent realisation that it is not necessary to look abroad for good taste in industrial art.

* * * * *

The exhibits, on the whole, are of a high standard; solid worth, rather than eccentric design, is the keynote of the exhibition, and nothing startlingly new has come to the surface. This is probably as it should be; for a certain conservatism fits in well with the British genius. The most successful sections are those covering the graphic arts, pottery, and glassware, and the most notable innovation is the appearance of certain substitutes for glass. Book-illustrations and posters are of a high standard and the ceramic designs are as good as anything we have yet seen. The Royal Academy, for staging such an exhibition, and British craftsmen, for producing exhibits of so high a quality, are to be warmly congratulated.

* * * * *

Capt. Guy Dollman, of the Department of Zoology in the British Museum (Natural History), in a recent letter to the Editor of *The Times*, makes pointed reference to the raid on rare Asiatic fauna mentioned in these notes last month. Capt. Dollman writes: "The Sze-Chuan Takin (*Budorcas taxicolor tibetana*) is, like the other two subspecies of takin, an inhabitant of the high mountain ranges of Central Asia, the species being distributed in Sze-Chuan, Shen-Si, and Kan-Su, as well as the typical locality, the Mishmi Hills. All three races are, comparatively speaking, rare animals, their scarcity in museum collections being evidence of this fact. Takin are accustomed to form into small herds as the summer approaches, and it was doubtless one of these herds which was encountered."

* * * *

"Presuming that the specimens were shot for scientific purposes," he goes on to say, "one is left with an uneasy feeling that the taxidermists of the expedition would have their hands more than full in dealing with ten animals of this size. If they were not all preserved and earmarked for museum purposes the killing of ten specimens of such a rare animal would seem to be unnecessary. Such a state of affairs would appear to show that the measures contemplated for the protection of the fauna and flora of Asia, on the same lines as the recent African convention, are not premature."

* * * * *

Visitors to Westminster Abbey owe a great debt of gratitude to Mr. Lawrence E. Tanner, Keeper of the Muniments at the Abbey, whose latest work (on Westminster School) is noticed elsewhere in this issue. The *Westminster Papers*, of which he is the author, are an admirable series of pamphlets dealing with various parts of the precincts; so far two have appeared: *The Library and Muniment Room* (6d.), and *The Norman Undercroft and Museum and the Remains of the Monastic Buildings* (3d.), both published by the Oxford University Press. These are not just the usual collection of antiquarian notes; the author, though an unimpeachable scholar careful of his references (which are copiously provided in footnotes), contrives to humanise the history of his "old buildings and old papers," almost in the manner of a Rochegude. And the man-in-the-

street, who is held by the hallowed charm of the Abbey but cares nothing for verifying references, will find them just as helpful as the scholar in search of the solution of a knotty point.

* * * *

IMPORTANT progress in botanical-archæological work is the main theme of this quarter's *Irish Naturalists' Journal*, which, indeed, is entitled "Quaternary Research Number." Dr. Knud Jessen, of Copenhagen, in response to a warm invitation following the success of his pollen-analysis in Scandinavia, visited Ireland and subjected various peat deposits to searching analysis, notably the Ballybetagh bog, famous for the discoveries of "Irish Elk" remains. The importance of the work is best summarised in Professor Jessen's own words: "If we know the exact place and layer in a bog where an implement of a fixed archæological period has been found, we can determine by pollen-analysis the exact composition of the surrounding forest at that particular period. It will then be possible, by the application of the same method to other bogs, to find which layers in them are of the same age." It follows that the co-operation of pollen-analysis and archæology has a two-fold result.

* * * * *

The age of objects which do not lend themselves to chronological studies can be determined from the type of surrounding peat or other ancient vegetation; and at the same time the recurrence of identical types of pollen enables the problems of habitation in past ages to be envisaged in a broad way; each discovery is no longer an isolated instance; it can with certainty be correlated, according to its surroundings, with other discoveries made in similar circumstances. As Dr. Mahr, Director of the National Museum in Dublin, writes: "A very vigorous compound branch of learning is in the process of formation, and it will be impossible to draw across it any line of distinction between the scientific and the historic aspects."

Is Britain to lose the red-legged chough? The danger of its extinction and the possible introduction of new blood from abroad are discussed on page 56.

The *Annual Report of Eton College Natural History Society* (1933-34) announces a successful season. We share the editorial hope that there will not again be a lack of bird records in the coming year. But it is good news to read that the Eton Bird Sanctuary campaign prospers; subscriptions to aid towards the preparation of the site will be welcomed by the Society. Mr. E. W. Hendy and Mr. Eric Hardy, in *Discovery*, have done admirable work in stimulating interest, among local nature societies, in the life and movements of British birds. Local botanical and entomological records are well kept up, and the notes on the day-to-day activities of the Society make enviable reading. We have not yet succeeded in spotting the "Golden Auriole" in the well-reproduced stained-glass design.

* * * * *

The acquisition for the nation of the Eumorfopoulos collection of Far Eastern antiquities and objects of art has raised again the question of the formation of a museum of Asiatic art, such as was recommended in the report of the Royal Commission on the national museums a few years ago. The collection is unique in several respects. It exemplifies all that is best and most characteristic in the genius of China in a period extending from the early part of the first millennium B.C. to modern times; and as its market value is placed at nearly half a million sterling it is unlikely that a similar collection will ever be formed again. On aesthetic and scientific grounds, therefore, as well as for sentimental reasons, it is a misfortune that this collection is to be exhibited in part in the British Museum and in part at South Kensington, in conformity with the conditions of its acquisition. In the interests of scientific and historical studies it is expedient that there should be a unified collection in which the development of the artistic ideals of Asia can be compared; and, as a temporary alternative to such a museum, it is interesting to learn that an exhibition of Chinese art is planned for Burlington House this autumn.

Recent Additions to the British Flora.

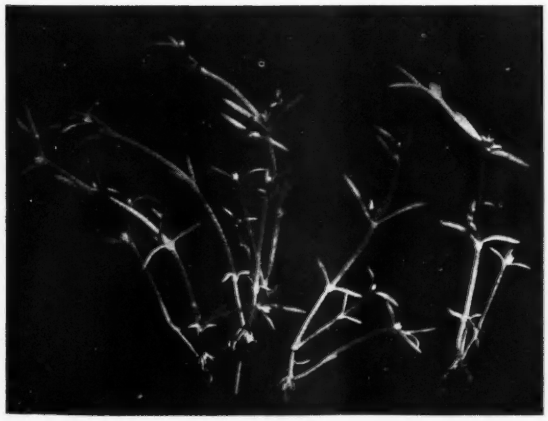
By E. J. Salisbury, D.Sc., F.R.S.

Quain Professor of Botany, University of London.

The native British Flora has been acquiring additions ever since agriculture was invented, but with increasing freedom of transport increasing numbers of plant immigrants have found their way to Britain. Botanists will find it interesting to see whether air traffic will prove responsible for the introduction of yet more new species.

It is necessary that at the outset we should explain the significance attached to the words "recent" and "additions" as used in the title of this article. If we ask ourselves what constitutes an addition to the British Flora, the answer is found to be by no means so simple as might appear. Every year there are reported numerous escapes from cultivation that have been found on waste ground, rubbish heaps, and similar places. Many of these are purely temporary occupants, like the Henbanes that spring up on fowl-runs, the Yellow Star-Thistles (*Centaurea solstitialis*) that are to be found in fields of lucern, or the grass *Cynosurus echinatus* that so frequently appears by canal banks. Such denizens, not destined to survive, cannot clearly be regarded as additions to our flora. Such often fail to produce any progeny and rarely withstand the competition of other species.

There are others more permanent. The shrubby *Bupleurum* that escaped from Jenny Lind's garden in the Malverns has been established there for a number of years and reproduces itself from seed. There is a locality in the south of England, by an ancient commercial rail-track, where that curious American member of the Compositæ, *Ambrosia maritima*, has remained for about a quarter of a century. One may say that such examples are known to be introductions, but it is almost equally certain that other plants, generally regarded without question as members of our flora, were introduced, some probably by the early Neolithic agriculturalists, others by the Romans. Indeed, the greater part of our flora has immigrated since glacial times, as the grip of ice and cold has gradually relaxed. We are then surely making an arbitrary and unwarrantable distinction if we try to draw any sharp line of demarcation between those species that reached these islands in the more or less remote past and those which have been immigrating during the last few centuries.



Tillæa aquatica, *a continental water-plant that has established itself in Yorkshire.*

An American grass, Bromus inermis, *flourishing beside the Grand Junction Canal.*

The criterion of an addition to our flora must be based, I think, not on when the species arrived, be it early or late, but on its behaviour subsequent to arrival. The test of incorporation with the native flora is capacity to endure competition in conditions undisturbed by man. To judge as to this is a matter of time, and so we must perforce interpret the term "recent" in a relative sense, since we cannot yet estimate the status of the most recent arrivals to these islands.

The history of the Pineapple Weed of Oregon (*Matricaria suaveolens*) is an interesting example of the importance of the time factor in assessing the status of a new arrival. This plant, first recorded from Wales in 1871, was found as a casual in several scattered localities

during the later years of the last century, but it was not till the beginning of the present one that it spread rapidly and demonstrated its capacity to oust its relative the Scentless Mayweed from waysides and the like areas. The fruits have probably in the main been spread in the mud on tyres, and the extension of its range has been associated with the rapid increase of motor transport.

New Types and Hybrids.

There is another type of " addition " to which passing reference may be made—namely, those which depend merely upon what may be termed botanical book-keeping. Botanists may, and often do, make two species grow where one grew before. The old aggregate is split up into two or more species one or both of which receive a new name. Studies which reveal the presence of types hitherto not recognised as distinct may indeed be concerned with recent derivatives from the parent stock, but in most instances it is the more probable that these plants have been with us all the time unrecognised for lack of critical study by the earlier botanists.

Amongst the many species of Lady's Mantle (*Alchemilla*), Hawkweed (*Hieracium*), and Dandelion (*Taraxacum*) that have been recognised in Britain in recent years, it is probably impossible to determine whether these are recent additions or not. The plethora of such additions in these genera has, however, its own significance since all three are pseudoparthenogenetic. Any new type is thus, in effect, vegetatively propagated and, in consequence, immune from the standardising influence of continual interbreeding with the surrounding population of the parental stock.

The numerous additions to the British list of Rubi and Roses during the past decade is significant of extensive hybridisation in these genera, and many of them may well be of quite recent origin, though some are sterile, whilst others have attained fertility by a doubling of their chromosome complement.

One comparatively recent addition that is almost certainly of hybrid origin is the Rice Grass (*Spartina Townsendii*) now so abundant in Southampton Water. First observed in 1870 near Hythe, its presence in the only area in Britain where the indigenous *Spartina stricta* and *Spartina alterniflora*, a presumed American introduction, both grew in proximity, at once suggested the possibility of hybrid origin, but the subsequent observation that *Spartina Townsendii* was completely fertile and that the progeny obtained showed no segregation of characters, but were uniformly like the parent stock, cast doubt on this explanation. The recent cytological investigation of Huskins has, however, shown that *S. alterniflora* has 70 chromosomes, whilst *S. stricta* has 56. The gametic cells would therefore possess 35 and 28 respectively, and a hybrid between them would be expected to have 63 chromosomes: an odd number involving unbalanced separation during reduction division, a condition normally accompanied by sterility. *S. Townsendii* proved to possess 126 chromosomes, so that it can be reasonably presumed that this type is a polyploid derivative from hybridisation of the two species already known which, like *Primula kewensis*, has attained fertility by a doubling of its chromosome complement. Thus balanced reduction division is possible and the absence of segregation is explained since each gamete will contain a chromosome complement from both of the original reputed parents. The vigour of the plant is a feature not without parallel in other hybrids, and its larger size is a common accompaniment of polyploidy.

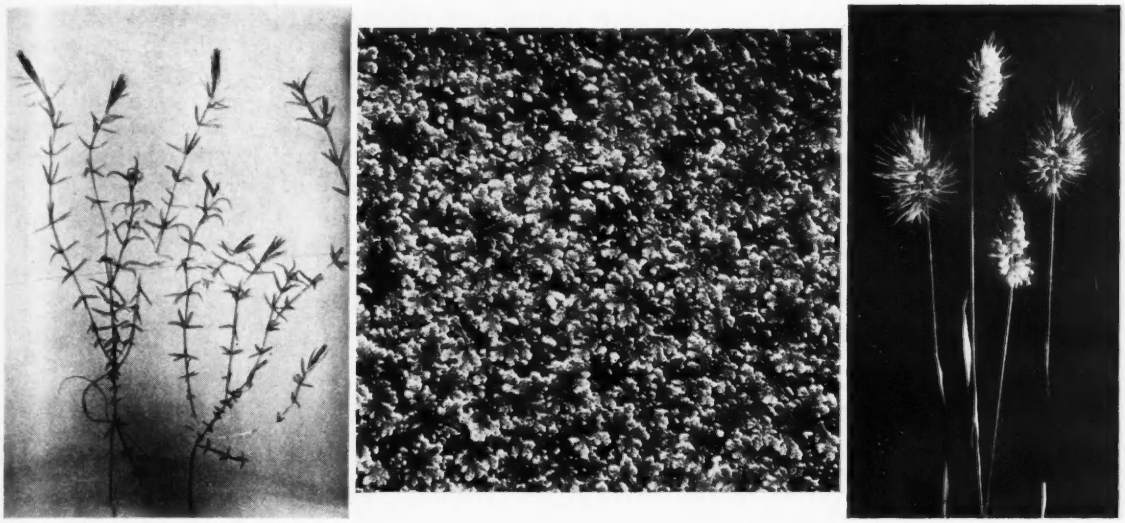
The putative hybrids that have been added to the list of British flowering plants during the past few years are numerous, but most of these are of very restricted distribution, and their recent recognition may well be due rather to the increase of intensive study than to the modernity of their origin.

The hybrid between the Cornish Heath (*Erica vagans*) and the common Heath (*Erica cinerea*), which was discovered by Mr. P. D. Williams in 1911, still remains very restricted in its distribution. The hybrid between the Herb Robert (*Geum urbanum*) and the Meadow Avens (*Geum rivale*) has been known since the time of Ray, but, though widespread to-day, having been found in nearly 60 per cent. of the British counties and vice-counties, it is probably scarcely, if at all, commoner than in former times.

Imports from America.

If, however, we turn to those additions which, though recent, have abided sufficiently long to judge of their capacity to endure competition with native species, we are struck by the comparative paucity of Continental types and the frequency of introductions from America. To the former category belongs the Scorzonera (*Scorzonera humilis*), a species of wide distribution in marshy places on the Continent, which was found by Mr. Sandwith in a similar habitat in Dorset in 1914. A still more recent arrival from the Continent is a water plant, a near relative of the Stonecrop—namely, *Tillæa aquatica*—which was found by Mr. Butcher in Yorkshire in 1920, since when it has remained.

But the recent additions from farther afield are far more numerous. The submerged aquatic *Hydrilla verticillata*, an Asiatic plant, was found by Mr. Pearsall in Esthwaite Water in 1914, where it has since flourished. Like its relative the Canadian Pondweed (*Elodea canadensis*), it does not, so far as is known, produce seed in



Hydrilla verticillata (*left*), *a submerged aquatic from a warm climate, now established in Esthwaite Water.* Azolla caroliniana (*centre*), *which has recently increased rapidly, growing in a Fenland ditch.* Cynosurus echinatus (*right*), *a frequent but temporary visitor on our canal banks.*

this country, but reproduces entirely by vegetative means. This state of affairs has not prevented *Elodea* from becoming a widespread and ofttimes abundant waterweed, and the same is true of the Water Soldier (*Stratiotes aloides*), a native of central and southern Europe. *Hydrilla* is one more example of the important fact that species which appear to require a warm climate for sexual reproduction may nevertheless persist in cooler regions if possessing an efficient means of vegetative multiplication. But whereas the Canadian Pondweed appeared first in 1847 in almost the centre of our Canal system, when this was at its zenith as a means of transport, *Hydrilla* arrived in a lake with a sluggish outlet.

Chief amongst the more recent additions are, however, those from America. One of these has already been mentioned. An example from the aquatic flora is the water fern *Azolla caroliniana*, which, although alleged to have been found in Britain in 1883, did not manifest any marked tendency to spread appreciably until the present century. Of land plants we may cite the American fodder grass *Bromus inermis*, which has appeared as a casual for some years, but now in certain stations is spreading despite competition with our native grasses as, for example, by the Grand Junction Canal. A number of species of American Asters has also become completely naturalised. Amongst other American introductions that have become firmly established we may cite the two species of *Claytonia*—namely, *C. perfoliata* and *C. alsinoides*—the former more particularly in the south of England and the latter in the north. Both have been known in Britain for more than three-quarters of a century, but it is only during the past twenty years that the spread of either has become conspicuous.

The Monkey Flower (*Mimulus guttatus*) has been with us for more than a century, whilst the American Balsam (*Impatiens fulva*) was first recorded in 1835, but even to-day their distribution shows how important has been our canal system in their dispersal. In this relation we may recall that another Balsam from India—namely, *Impatiens Roylei*—is now fully established in a number of stations. It, too, though first seen as a naturalised plant some eighty years ago, has shown a marked tendency to spread during the past few years.

If then it be true, as appears to be the case, that the provenance of the more recent introductions is distant lands rather than the nearer Continent, it would suggest that most of the members of the European Flora that can grow in these islands sufficiently well to battle with the native plants have already arrived, whereas the sifting process of contributions from more remote sources is still actively continuing. So far as one can judge, the only agency of dispersal that has materially altered is the rôle of man. Let us avoid the pedantry that regards dispersal by man as in a different category from that of other agencies. Except perhaps when his action is deliberate, the rôle of man in this respect is just as much a natural agent of dispersal as any other. Even when he acts deliberately is his action any different

biologically from that of the ant which conveys a gorse seed from one place to another? But whether we choose to be pedantic or not, the changing provenance of our floristic recruits strongly suggests that the influence of man has played no small part in the colonisation of these islands.

The few examples we have had space to mention of species which have become firmly established in our flora show that the immigration of species into Britain which can be traced back, through the sub-fossil remains, into the remote past, is still continuing. The activities of man have from time immemorial facilitated this process, and with increasing rapidity and multiplication of methods of transport the range and frequency of such introductions have been augmented. To-day the aeroplane may carry, on its landing wheels and on the clothes of its passengers, fruits and seeds from the most remote parts of the world, so rapidly as almost to preclude the possibility of any loss of viability in transit. It may be these seeds are destined only to perish, but some may germinate and become a welcome addition to our flora, or perchance a pestilential weed. In either event we realise that the British Flora is not static but dynamic, and those accretions that persist constitute a living witness to the efficacy of competition as an agent of selection.

Butterfly Immigrants in Britain.

By C. B. Williams, Sc.D.

Chief Entomologist, Rothamsted Experimental Station, Harpenden.

Entomologists have discovered that the butterfly population of Britain is increased from time to time by waves of immigration. The rhythm of these migratory movements is irregular and their reason as yet unknown. Dr. Williams tells observers what to look out for and appeals for reports to be made which may add to the present stock of information.

DESPITE a widespread belief to the contrary there are quite a number of butterflies which spend a considerable length of time in the adult stage: frequently a week or more; not rarely a month or so; and sometimes even as long as eight or ten months, which latter period, however, usually includes a period of dormancy or hibernation. During this relatively long life some species flutter to and fro within a limited area, as often in one direction as another, while others occasionally develop that remarkable habit of flying steadily in one direction that we call "migration." Everyone is familiar with this habit in birds and locusts, but the fact that it occurs in butterflies throughout the world and in quite a number of the butterflies of this country is still but little realised.

Next to nothing is known of the reasons for this extraordinary instinct, or of the means by which the migrating insects keep to their steady direction, but it is now a well-established fact that many butterflies, usually shortly after hatching from the chrysalis, set off on a flight in a fixed direction, sometimes singly, sometimes flying together in such large numbers as to resemble a snowstorm. These flights may continue for many days and as a result the butterflies reach localities hundreds of miles from their start. In the tropics great clouds of butterflies flying steadily in one direction have many times been recorded, but in temperate climates the movements are less obvious and often require the most careful and continuous observation to establish their reality.

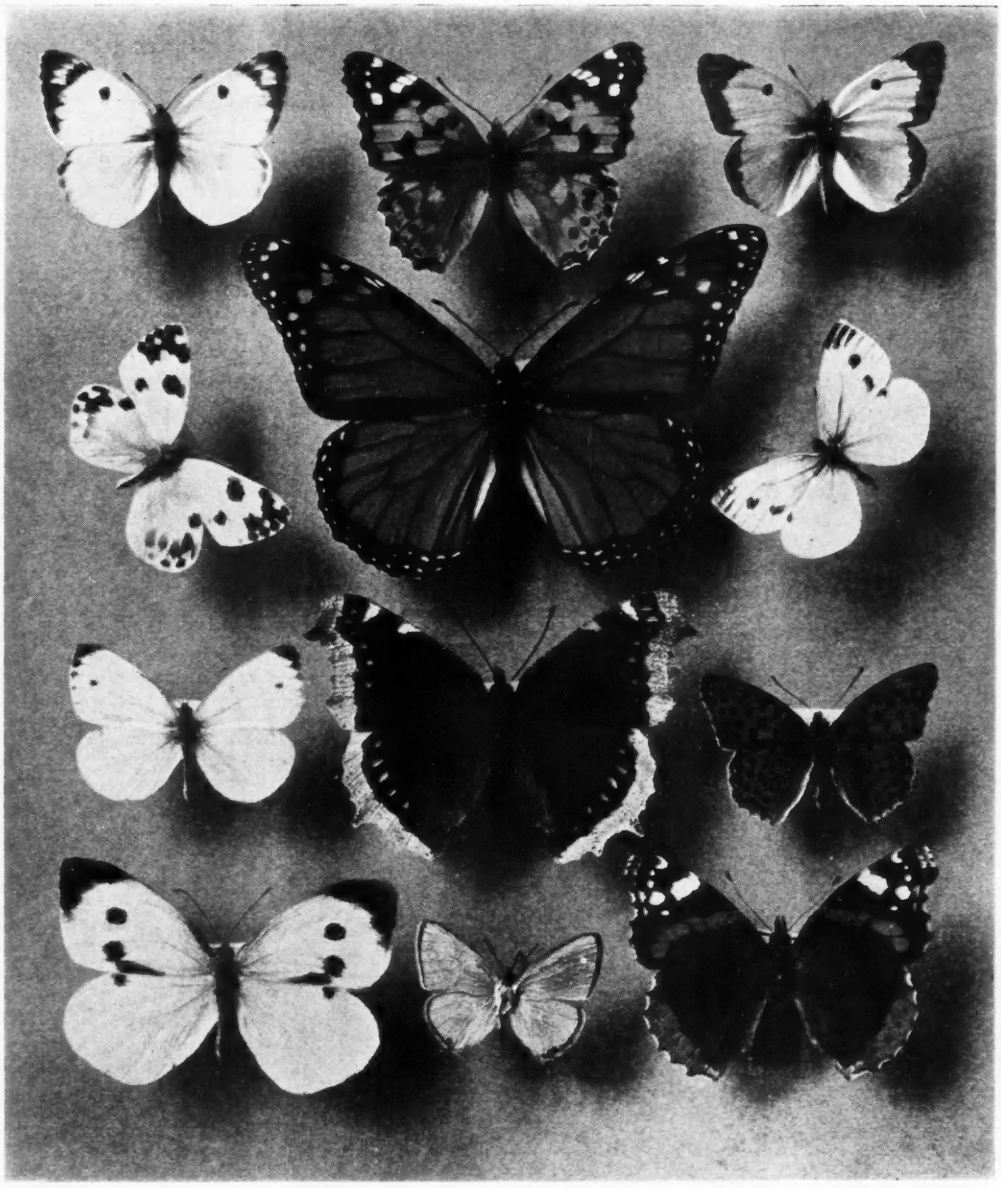
In Great Britain sixty-eight species of butterflies have been recorded, some common, some rare, and some now extinct. Of these about twelve species are known to migrate and, with one exception, the immigrants reach our shores from the Continent of Europe in larger or smaller numbers each year. Some are unable to survive the winter here in any stage, and so we are entirely dependent on immigration for our stock. Others breed regularly and continuously in Great Britain, but are reinforced by waves of immigration from the Continent at irregular intervals. Although in one or two cases there is still a slight doubt existing on some points, the following table gives a general classification of the British migrant butterflies.

(*a*) Migrants which reach our shores, but never complete a generation, so that no specimens captured in this country are "home-bred":

(1) The Bath White (*Pontia daplidice*).
(2) The Camberwell Beauty (*Nymphalis antiopa*).
(3) The Queen of Spain Fritillary (*Argynnis lathonia*).
(4) The Monarch or Milkweed (*Danaus plexippus*).
(5) The Long-tailed Blue (*Cosmolyce boeticus*).

(*b*) Species which reach our shores and may breed one generation during the summer, but never (or very rarely) survive the winter:

(6) The Clouded Yellow (*Colias croceus*)
(7) The Pale Clouded Yellow (*Colias hyale*).
(8) The Painted Lady (*Vanessa cardui*).
(9) The Red Admiral (*Vanessa atalanta*).



BRITISH IMMIGRANT BUTTERFLIES.

Top Row: *Pale Clouded Yellow; Painted Lady; Clouded Yellow.*
Second Row: *Bath White; Monarch Butterfly; Green-veined White.*
Third Row: *Small Cabbage White; Camberwell Beauty; Queen of Spain Fritillary.*
Fourth Row: *Large Cabbage White; Long-tailed Blue; Red Admiral*

(*c*) Permanent residents reinforced by immigration from abroad :

(9) The Red Admiral (*Vanessa atalanta*).
(10) The Large Cabbage White (*Pieris brassicae*).
(11) The Small Cabbage White (*Pieris rapae*).
(12) The Green-veined White (*Pieris napi*).

Some Rare Visitors.

Dealing with the different species in the order given above :—

(1) The Bath White has its headquarters along the Mediterranean but ranges also south to South Africa. Mass migrations have been recorded in Russia and South Africa but only rarely do individuals reach this country. In 1872 thirty-six specimens were captured and in 1901 a considerable number, almost all on the south and south-east coast. Apart from this only a few have been captured, but it is quite likely that many have been passed over by collectors, owing to the close resemblance of this species to the other white butterflies.

(2) The Camberwell Beauty is a large butterfly which, unlike most other migrants, arrives on our shores chiefly in the autumn, and almost certainly comes from the east across the North Sea, probably from Scandinavia. In its home it hibernates as an adult and lays eggs in the following spring. After years of considerable immigration in the autumn, occasional spring specimens are seen in this country, which may perhaps have hibernated here, but so far as I know, no caterpillar has ever been found in Britain and there is no evidence of breeding having taken place. The study of the immigration of this species has been made more difficult of late by the liberation in this country of large numbers of adults from pupae obtained on the Continent.

(3) The Queen of Spain Fritillary is another very occasional straggler from the Continent. Numbers were captured along the south coast in 1818, 1868, 1872, 1880, and 1882 ; but between those dates and since the last, only single specimens have been captured at intervals of some years. No larvae, eggs, or pupae have ever been found in this country, but once or twice adults have been found in the autumn under conditions that make it possible that they had emerged from eggs laid by spring immigrants.

(4) The Monarch Butterfly is the only one of our immigrants that does not come to us from the Continent of Europe, where its food plant " milkweed " (*Asclepias*) does not occur except in cultivation. The butterfly is found in the Azores and Madeira but it is almost certain that our occasional immigrants come from North America where it is abundant. In this continent the species makes massed flights to the south in the autumn, and apparently some of these flights get accidentally carried out to sea when, assisted by the prevailing wind, some stragglers survive long enough to reach our shores. Altogether over seventy specimens have been recorded as captured or seen in Great Britain and Ireland and of these over thirty were recorded in 1933, when a quite unprecedented immigration occurred. With only very few exceptions the records are from the south coast of England, particularly in its western half. There are also two or three records from Ireland.

(5) The Long-tailed Blue is another butterfly of very wide distribution throughout the world, which occasionally reaches Great Britain from the Continent. Mass flights have been recorded in India and I once captured a specimen on a steamer in the Mediterranean when about 30 miles from the Egyptian coast towards which we were sailing. Only a dozen or two individuals have been captured in England, nearly all along the south coast, but it is not uncommon throughout France, and in 1899 over one hundred specimens were captured in the Channel Islands. In the same year two only were recorded in England.

Welcome Invaders in Summer.

(6) The Clouded Yellow comes to us from the south nearly every year in larger or smaller numbers. The first immigrants arrive in May or June and in the early autumn there may be further immigrations, or eggs laid by the spring invaders may produce a home-bred brood. There are occasional records of third-brood larvae and one hears of adults being seen in late autumn or early winter, but there is no convincing evidence at present that any individuals survive the winter in the wild state. The butterfly is most frequently seen on the south coast, but in years of unusually large immigration, such as 1859, 1862, and 1877, it is common as far north as Scotland, occasionally even reaching the Orkney Islands.

(7) The Pale Clouded Yellow is very similar in its occurrence to the last species, to which it is closely related, but it is decidedly rarer and seldom, if ever, reaches as far north as Scotland. The years of abundance of this species bear no relation to those of the Clouded Yellow ; either may be common with complete absence of the other, while in 1892 both species were common together.

(8) The Painted Lady is one of the most widely distributed butterflies in the world, being found in every continent. In Great Britain, however, few, if any, individuals survive the winter. Early in the year large numbers are sometimes seen entering the regions along the North African coast from the south, but where they come from is still a mystery. Only once has a flight been seen to start, and this was in the Sudan. Many

times they have been seen crossing the Mediterranean from south to north, usually about May, and then they go on across Europe, reaching England about the end of May or early June. In occasional years stragglers reach as far north as Iceland in the west and almost to the Arctic Circle in Russia and Siberia. In North America the same butterfly flies north through Southern California in the spring, sometimes in countless millions, and spreads throughout the States and as far north as Hudson Bay. Nearly every year there is an immigration into England, sometimes on a large scale, sometimes with only very few individuals. Those arriving during May or June lay eggs which give rise to home-bred butterflies in August and September. These, however, do not seem to lay to any extent and it is possible that they move southward, though this fact has not yet been definitely established. Sometimes, on the contrary, there is an autumn immigration into England from the Continent. This was very striking in 1903 when thousands of individuals invaded the south-eastern counties about September 20th. On the other hand, in 1879, in the June of which occurred the greatest invasion of western Europe ever recorded, there was a large and definite return flight from England to France about the middle of August.

(9) The Red Admiral butterfly has to be put into two categories in the list above, as it is still uncertain whether any individuals normally survive the winter in Britain. In any case the fact remains that many come over from the Continent in the early summer and there is accumulating distinct evidence of a return flight southward in the autumn. The spring immigration is in May or June and, as in the case of the species just discussed, these invaders lay eggs which produce home-bred butterflies in August. There is, however, in this species also, evidence of occasional autumn immigration, which makes the evidence with regard to any autumn southward flight distinctly confusing.

Hardy Annuals.

(10, 11, 12) The three common white butterflies can, in the present state of our knowledge, be dealt with together. They are all resident species which are reinforced at intervals by immigration from the Continent. The Large White and the Small White have many times been recorded in mass movement; the Green-veined White only seldom. Unfortunately in many of the recorded flights the exact species has not been determined. In the case of the Large White and possibly also the Small White, there is some evidence that the swarms originate in Southern Scandinavia or on islands in the Baltic and that they fly, usually about June or July, southward through Germany or westward across Holland and Belgium to England. Most of our recorded invasions are in the southern half of the east coast or the eastern half of the south coast. In early August, 1932, a mass movement, chiefly of Small Whites, was recorded in Belgium; a few days later numbers were seen coming ashore on the Norfolk coast, and almost at the same date they were seen passing to the west at Harpenden, which is about seventy-five miles inland. Earlier movements during May and at the beginning of June have also been observed, but so far the source of such swarms has not been traced.

Whence come they, and Why?

We see, therefore, that the butterfly fauna of Great Britain is considerably augmented every year by this extraordinary habit of migration. We are beginning to understand the elementary facts about the species involved and when they move, but the exact areas from which our invaders come is practically unsolved in every case. It is difficult to believe that in a continent so thickly populated as Europe it should be possible for swarms of tens of millions of Cabbage White butterflies to be seen flying regularly south through Germany without anyone having seen such a flight start, or without anyone knowing even where to look for the origin, but such is the case.

If our knowledge of the facts is so scanty, what can we expect when it comes to trying to explain the reasons for the movement and the means by which butterflies keep to their direction? We can only say that we are ignorant in good company, for the students of bird migration, who have a thousand times as many observations at their disposal, and who are able to mark birds with some reasonable hopes of recovery, are still as much at a loss in the fundamental problems as we are in the study of insect migration.

Readers of *Discovery* can help by sending in to the present writer details of any flights of butterflies that they may have observed in any part of the world, or of any butterflies captured at sea well away from land. Records of such flights should include the date, direction, and locality of the observed flight, and wherever possible a few specimens, the condition of which does not matter. If specimens cannot be sent, then as good a description as possible of the size and colour of the insects concerned should be given.

In last December's issue of *Discovery*, on p. 351, it was stated that the distance between New York and Los Angeles was 3,300 miles, as the crow flies. The correct distance is, of course, 2,300 miles.

New Knowledge of the Stratosphere.

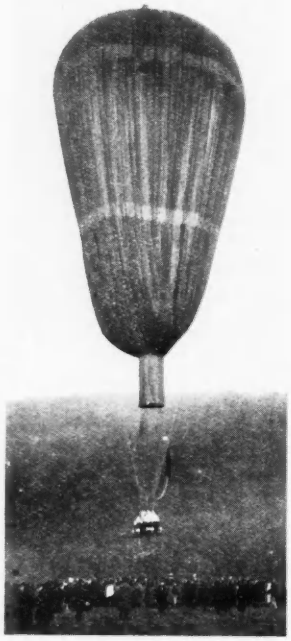
By L. Reid.

Of recent stratospheric expeditions those of Brussels University have proved most successful. The ascent of Professor Cosyns in 1934 attracted much public attention, but the full scientific results are not yet made known. Mr. Reid, who is in close touch with events in Belgium, here gives a concise account of some of the inventions which have furthered exploits in the upper air, as well as some idea of the direction in which stratospheric researches are likely to point.

At the beginning of 1931 the stratosphere was an unknown region. Since that time several expeditions have been made into a stratum where man cannot breathe, but must take his supply of oxygen with him. All these ascents have been made on the "Piccard" system, the Swiss, Auguste Piccard, on the teaching staff of Brussels University, being the first to penetrate the mysteries of these spaces. Shutting himself and his pupil, Paul Kipfer, another Swiss, into an airtight gondola of duralumin attached to a giant balloon, the professor was shot into the stratosphere, at a single bound, from Central Europe. The experience gained in the first ascent enabled Piccard and his pupil, Max Cosyns, a Belgian, of Brussels University, to make a more leisurely ascent in the following year. On August 18th last, Professor Cosyns and a Belgian student, Nerée Van der Elst, went one better than their master and rose slowly and deliberately from Belgian soil, where weather conditions are far from ideal, sailed over half Europe, and then rose into the stratosphere, in a region where settled weather conditions permitted. The advance made within the period of three years is immense. Piccard was forced to wait for weeks at Augsburg—the spot in Europe least affected by climatic changes and varying winds—for a perfectly calm day, without wind. At Zurich, again, the trip was postponed until weather conditions were ideal. Cosyns chose Hour Havanne, in the Ardennes, for making his ascent, because he could take off in a windless atmosphere, Hour Havanne being surrounded by high hills. Once started, he was more or less indifferent to weather conditions, until he reached the point of ascent into the stratosphere, in mid-Europe.

Piccard was an enthusiastic balloonist, but Cosyns had only made the necessary ascents in an ordinary balloon to obtain his pilot's certificate, while Nerée Van der Elst had been up only on two occasions, which tends to show that skilled navigators are not essential in the stratosphere. The occupants of the gondola require rather a scientific training in the handling of the delicate instruments necessary for making observations. The technical preparations for stratospheric expeditions, planned down to the last minute detail by Professor Piccard, are in the hands of army experts, not in those of scientists.

At Hour Havanne the gondola had been hanging from a scaffold in a field for many days; the scientists had filled its restricted space to the utmost capacity with instruments, leaving barely room for themselves. They carried parachutes for themselves and for some of the heavier lead apparatus required for experimenting with cosmic rays; also supplies of oxygen and some light refreshments. The gondola was the chief object of curiosity to visitors, but far off at the end of the field the balloon corps was busy with material brought from its depot and carefully guarded by sentinels. The process of partially filling the huge balloon with hydrogen took four hours, and every detail of the difficult task was carried out with military precision. Finally, the gondola was attached to the balloon and soldiers hung at the end of ropes until the word to let loose was given. The balloon rose, cleared the surrounding trees and hills, and was carried away in the wind. Belgium waited anxiously for news of the stratosphere explorers, who finally landed at Zenavelje, in Yugoslavia, without trouble. They had gone up with the gondola door open, for the first two miles, and they came down breathing ordinary air. They returned to Brussels by air, and, according to their own accounts, are inclined to make light of trips in the stratosphere, although other explorers have been killed, forced to use parachutes for the descent, or subjected to other mishaps on their journeys. Professor Piccard, his pupils say, has never failed in an



Cosyns ascending with the partially inflated stratosphere balloon. The stabilising sleeve is seen at the top of the balloon.

experiment, and his success and that of his disciples is doubtless due to minute attention to details, for Piccard has devoted his whole life to the study of the stratosphere and its cosmic rays.

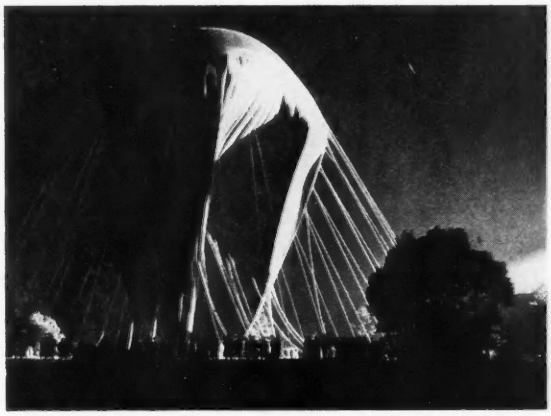
Neither Piccard nor Cosyns, up to the present, has had a great deal to say about the results of their expeditions, though they admit that the business of harnessing cosmic rays, of forcing them to do the work of electricity, is proceeding apace. Piccard himself goes so far as to declare that when a slight advance in science has been accomplished a great city like London will be able to be lighted for a whole night for a single halfpenny; while Cosyns states that his researches into the problems of atmospheric and stratospheric ozone have been fruitful.

Belgian scientists are particularly interested in the presence of layers of ozone in the stratosphere, and the ascents into the stratosphere from Belgium are regarded simply as incidents in the course of a long series of experiments made by means of sounding balloons sent to a height of twenty miles to register the temperature and other data in the stratosphere.

The invention four years ago, by M. Jaumette of the Brussels Observatory, of a new light-weight case for

The cap of the deflated balloon, showing the stabilising sleeve for facilitating observations and safe descent. The balloon fabric lies spread out on the ground.

instruments has greatly increased the number of possible experiments, owing to the elimination of any danger from the falling of cases attached to balloons that burst in the stratosphere. This receptacle, weighing about ten ounces, bears the name of the observatory from which it is sent out and a promise of a reward to the finder who returns it. When a sufficient number of problems have been solved by the sounding balloons, an expedition into the stratosphere is made to ascertain, for instance, the direction of rays, and such other



The balloon in preparation; it is inflated to only one-seventh of its capacity to allow for dilatation in the zones of rarefied air.

problems as cannot be solved without human presence. The practical results of these experiments with ozone in the stratosphere are eagerly awaited in trade and commercial circles. Meteorologists in Belgium believe that the seasons vary in accordance with the altitude of ozone in the stratosphere, as ozone absorbs large quantities of ultra-violet rays. If this belief is well-founded, it will most likely be possible to foretell hot and dry summers and cold winters many months ahead.

Over and above their success in these very important ozone researches, Cosyns and Van der Elst are the first stratospherists to use a stabiliser successfully. Similar contrivances have been attached to balloons before, but hitherto the occupants of the balloons have always come to grief, and no record of the usefulness of such stabilisers exists, except that brought back by the Cosyns expedition. The stabiliser enabled the stratospherists to remain at any desired height on their voyage, and to make observations at any stated altitude, a very great advance towards establishing the utility of stratospheric navigation.

The expeditions of Piccard and his pupils have been paid for by the Belgian National Scientific Research Fund, raised at the suggestion of the late King Albert. Most of the money was contributed by big industrial concerns, and the fact that these institutions, who keep a strict watch on these funds, have subsidised three expeditions, is the best guarantee that real progress is being made in the process of turning cosmic rays into hard cash. The balloon (christened *Piccard-Cosyns*) and gondola have been presented by the Fund to the Brussels Aero Club in the hope that they may serve for future expeditions.

Are Rocket Mails a Possibility?

By J. G. Strong, B.Sc.

Member of the British Interplanetary Society.

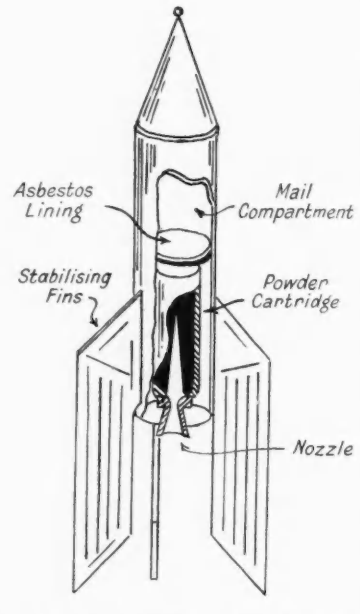
The advantages of transmitting mails unaccompanied through the air are obvious; and experiments with mail-carrying rockets are in full swing. Mr. Strong shows how recent trials have met with varying fortune, and his indications of the ways in which success may be attained are full of interest.

THE recent endeavours to despatch rockets carrying mail from the island of Scarpa to the mainland of Harris, in the Outer Hebrides, and from Hampshire to the Isle of Wight, have focussed attention on a subject which claims widespread interest. Although on these occasions the experiements ended unsuccessfully, the charge, in one case, exploding when fired and wrecking the apparatus, while in the other case the rocket swerved from the line of flight and came down on marshy ground a mile away, previous attempts have shown that the idea bears distinct possibilities.

The history of rocket mails began in 1931 when Herr Tilling, a German inventor, succeeded in despatching some 200 postcards vertically upwards for 1,800 metres by means of a rocket. On landing the cards were re-despatched to their owners by the postal authorities. Later in the same year the feat was emulated by an Austrian, Herr Schmiedl, who established the first scheduled rocket postal system between the Schöckel and Radegund, near Graz. Schmiedl employed powder mixtures, varying their quantity so that the fuel would be exhausted when the rocket was over its destination; a parachute being then released automatically which landed the mail safely.

These trials aroused the interest of Herr Zucker in Germany, and in 1933 he carried out a successful rocket-post flight over the Harz mountains, transporting upwards of 400 letters. Further exhibition flights of three kilometres or so were held from time to time in collaboration with the postal authorities, the proceeds being devoted to the German Winter Relief Fund. Zucker's postal rocket was unconventional, and indeed looked rather cumbersome. The body was cigar-shaped, winged at the nose and tail, and was constructed chiefly of sheet aluminium. From the rear projected four steel rocket tubes, while six others were mounted on the forward wings. The front half of the body contained space for the mail, and behind, separated from the rear tubes by a heat-resisting bulkhead, lay a smaller compartment for the parachute. The overall length measured some nine feet. Powder rockets were used, the firing being carried out electrically. When ready, the rocket rested in an openwork cradle which served to hold it down and give initial direction until it gained flying speed.

The single-tube rockets built by Herr Zucker for the Scarpa-Harris and the Hampshire experiments were smaller and of different construction. The partial failure of the Hampshire rocket was due to a high wind which deflected it so that eventually it travelled at right-angles to the original setting; it now appears doubtful as to whether stabilising fins do control the direction or whether they are not a disadvantage, as presenting a greater surface to a cross-wind. Whilst it is easy to criticise at this stage, it seems probable that a straightforward, bullet-shaped projectile would have had more chance of success, especially if the launching cradle had been designed so as to spin the rocket on its axis, much as a shell is prevented from wobbling by the rifling of a gun. The formula of the powder propellant was improved after the Scarpa-Harris fiasco but the relatively short distance flown demonstrates the fact that the fuel problem still remains to be solved.



Section of a single-tube mail-carrying rocket.

Practically the whole trouble in rocket-mail flying, and in rocket propulsion generally, revolves around this question of finding a suitable fuel, and it is a little vexing to know that although a number of materials can be made to give the

requisite energy, we have no means as yet of controlling the power once it has been liberated.

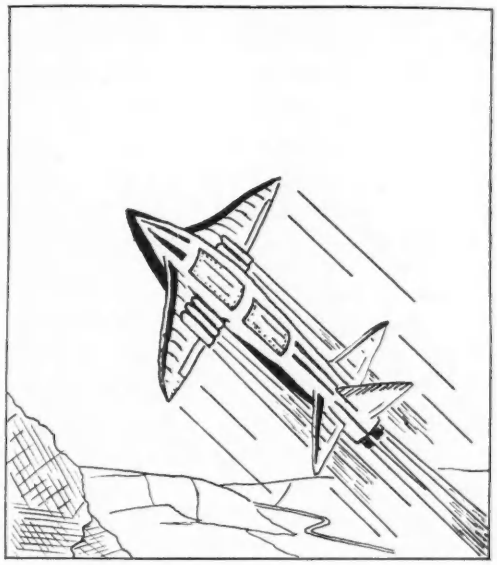
At present there exist two schools of thought regarding the problem. Firstly, those who favour solid fuels, such as the black powders, and whose experiments it must be admitted have been attended by a considerable amount of success. And, secondly, the groups who consider liquefied gases, such as methane, ethylene, and hydrogen-oxygen systems, to be more useful. The latter, however, can point to only one instance of success so far and for the moment the laurels appear to rest with the solid fuel experimenters.

Opinions differ widely on the question, though I am personally inclined to think that the ultimate answer will be found by neither group but by a third party rising to claim the use of liquid high explosive rendered free from brisant effects, possibly by a variation in manufacture or by the addition of a catalyst. But before going further it would be well to see whether there is any theoretical support for a particular group.

Gunpowder when exploded in a confined space can give pressures as high as 70,000 lbs. per sq. in., and by restricting the throat of a rocket tube it is in some measure possible to control both the pressure and speed of the ejected gases. Mechanical feeding of solid powder introduces a difficulty, and a packed cartridge provides no means of shutting off power once the reaction has started.

The liquefied gas systems have it in their favour that they can be readily controlled, and, moreover, the rate of expansion of their resultant gases is higher, namely 8,000 ft. per sec. as compared to that of gunpowder which is only 1,000 ft. per sec. What appears to have been overlooked is the ridiculously low pressures that these gases exert—only 50-100 lbs. per sq. in. Thus a rocket cannot be started unless the major percentage of the fuel is ignited, which reduces the thought of a lengthy flight to an absurdity. Petrol-air mixtures belong to a similar category, for although Newton's momentum equation (MV=mv) applies in free space, to an earth-bound rocket pressure is more important than velocity, and for practical purposes the low-pressure gaseous systems are almost useless.

To entertain the use of high explosives as a propellant appears reckless, but it is only in this field that the combined requirements of speed and pressure can be satisfied. If the inherent danger of detonation can be removed and the question of control simplified by the use of a liquid fuel, the outlook would become considerably brighter than it is at present. Liquid nitroglycerine and nitrobenzene can generate pressures of 50,000 lbs. per sq. in. with speeds of 20,000 ft. per sec., so energy is available in abundance. Trinitrotoluene and picric acid are yet more powerful, but being solids are limited for the same reason as gunpowder, though there are numerous other liquid derivatives of the benzene group which could come in for consideration. The problem is one which calls for skilled knowledge in



The multi-tube parachute rocket used for the Harz Mountain experiments.

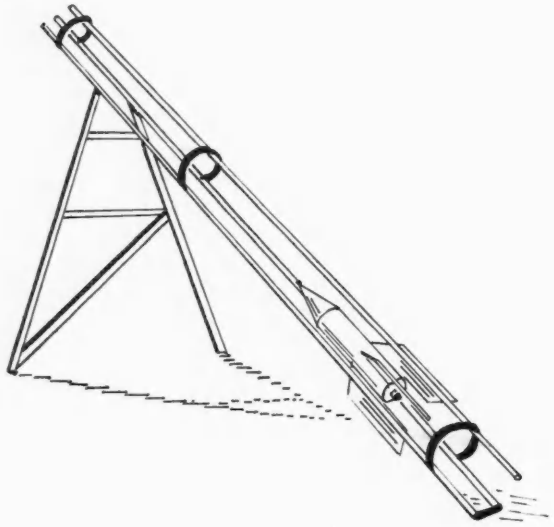
explosive engineering. Normally the reaction of these materials is too violent to permit their use even for gunnery, and it is difficult to say whether an open-ended tube such as a rocket would stand up to the thrust on full load without becoming "mushroomed."

Little is yet known as to the exact nature of brisance, or the property of detonating at the slightest shock, which these explosives possess. Generally it is believed to be due to the releasing of a strained molecular equilibrium, a chemical state set up during manufacture. The releasing of this strain gives birth to a vibration sufficiently powerful to break up adjacent equilibria, while the subsequent decomposition of the entire mass sends out a train of waves capable of breaking down similar explosives if they are not stored at a safe distance. On detonation the molecular arrangement decomposes almost instantaneously to that of a gas whose covolume is many thousand times that of the original substance. The resultant effect of multiplying pressures is nothing less than shattering as can be imagined. The stabilising of these explosives so that their energy may be tapped without provoking a major disturbance will require expert knowledge, though there is hope in the fact that

the addition of certain chemicals is known to reduce the rapidity of decomposition, this property being utilised for certain types of armour-piercing shells.

With the hoped-for increase in the time of rocket flights the drawback of generating high temperatures is almost certain to manifest itself, especially when pressures are high. Incandescent gases at temperatures ranging to, say, 3,000° C. attack steel like acids, first forming a hard "pearlite," which later becomes porous, erosion rapidly setting in. An example of this is given by the firing of a 10-in. gun, two ounces of muzzle iron vanishing in the form of a gas at every shot. Tough alloys like manganese-bronze melt like butter under the combined influence of high temperature and pressure, and it is possible that materials a good deal stronger than those we now possess will have to be developed.

We have now dealt with some of the problems which confront the science of rocketry, as it is called. The work continues even in the face of such obstacles and the tragic loss of life that has marred its progress. Herr Max Valier, who in the past contributed several articles to *Discovery*, and who did much to establish the science on sound practical lines, was fatally injured some years ago by a bursting rocket tube while experimenting with liquid fuels. Herr Tilling, whom we mentioned earlier,



Guide-cradle for launching single-tube rockets.

and two of his assistants were killed outright by the unexpected explosion of his fuel supplies while he was trying out a new mail-rocket, and from time to time others have had narrow escapes. In spite of these deterrents the German Society has pushed forward its "Mirak" or model rocket programme, and has lately developed a "Repulsor" type which has proved successful in trials employing liquid fuel.

The Leningrad University Observatory is stated to be building a high-altitude instrument-carrying rocket for stratospheric work and a similar project is now announced from America. From India comes recent news that a mail rocket safely flew 1,000 yards from the deck of a small mail-boat passing up the shoal-infested estuary of the Hooghli. It is understood that the postal and military authorities were so impressed by the demonstration that they are investigating the possibilities of its operation in the mountainous frontier country. The interest aroused is significant. Many ingenious designs are being put into practice everywhere, and to facilitate the work of experimenters in various countries an International Society for the exchange of data and ideas has been formed.

A little over a year ago a British Society was formed for the purpose of forwarding the work of experimenters in this country. Many well-known scientists and inventors have expressed their interest by joining, and it is to be hoped that when rocket flying is finally perfected we shall be able to point out our share towards its accomplishment.

Bullace Revival?

A MORE prominent place in the sun of popular favour and of pies, the *Fruit Grower* states, is being urged for the bullace—a name applied horticulturally to those wild forms of *Prunus insititia* which are native to this country. The horticultural distinction is that the bullace is a round plum and a damson an oval one; botanically there is (as E. A. Bunyard points out) no such line to be drawn. By not ripening until late October or November it is the last of the plum kinds, and may remain ungathered until the leaves fall, being understood to be improved by a touch of frost. A letter writer in the daily press deplores how little "the valuable and delicious bullace" is known or appreciated.

"Half a century ago," he declares, "it was much esteemed, ~~especially for pies. The excellence~~ of its brisk flavour—sometimes described as 'austere'—is quite distinctive and merges delightfully with Cornish cream. The richness of its juice in pies surpasses that from most varieties of plums; and when preserved, unlike other jams, it retains its unique crispness of flavour without cloying excessive sweetness." For pies and puddings the damson is probably more to the taste of the modern palate, but for the best of all jams nothing can beat a cunning compound of blackberries and bullaces.

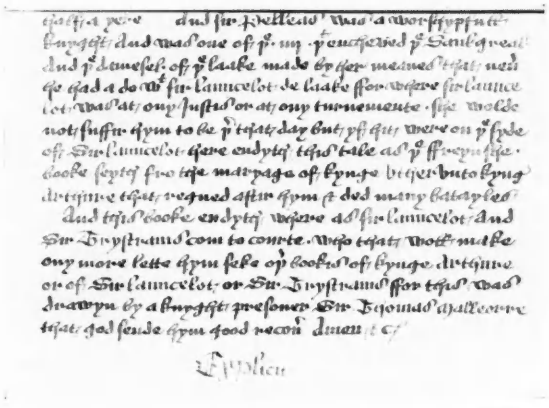
The Manuscript of the Morte Darthur.

By W. F. Oakeshott.

Librarian of Winchester College.

It seems almost incredible that so important a document as the manuscript of the Morte Darthur *should have lain hidden for over four centuries. Mr. Oakeshott's account of its discovery should encourage search among the archives of Britain for other literary treasures of equal interest.*

THE only known work of Sir Thomas Malory is the *Morte Darthur*. It was finished, as we are told by Caxton (who first printed it), in 1469. Though there were books being printed in several continental towns by that date, none had yet been printed in England, and it was not until 1486 that Caxton printed Malory's work "in the Abbey at Westminster," as he says. The book does not seem, however, to have been often copied in the intervening period, for until the discovery last June of a manuscript of the *Morte Darthur* in Winchester College Library none was believed to have survived. Caxton's edition itself is a great rarity, known only through two copies, and it was on one of these that the edition of Southey which popularised the book in the 19th century, and later the critical edition of Sommer were based. Caxton indicated in his preface that he was responsible for dividing the work into books and chapters, but it was impossible to say whether he had undertaken any more drastic revision, and whether any of the obscurities of the text were due to omissions or alterations which he had made. All that could be said for certain was that other prose works which left his press often bore considerable traces of revision and addition by him.



The mention of the "knyght presoner Sir Thomas Malleorre" seen here was the first certain identification of the author of the Morte Darthur.

For these reasons the discovery of a manuscript of the *Morte Darthur*, very nearly complete, is of great literary interest. It would no doubt have become known long ago had it not been that the entry referring to it in the catalogue of the Winchester manuscripts (made about a hundred years ago) was misleading; and this incidentally gives reason to hope that other similar discoveries may be made elsewhere as old collections not recently catalogued are re-examined. The book is a fair specimen of the caligraphy of the period at which it was written, for though the attempts made at illuminated initials are (as might be expected at so late a date) rather decadent in style, the better of the two hands in which it is written is regular and handsome, and the device of writing proper names in scarlet throughout gives the page a definitely artistic quality. The probabilities are that it was written between 1469 and 1486, though this cannot be definitely proved. With such a date the palæographical evidence is consistent. It is certainly not Malory's autograph, and equally certainly not the manuscript used by Caxton; although the discovery that a torn page had been mended with a fragment of vellum printed by Caxton himself in 1489 might seem at first to suggest the possibility that it had been in his hands. Actually this fragment was probably "printer's waste" sold to a London binder of the period for use in repairing (much as printer's waste is often used nowadays by publishers and booksellers for packing), and its presence probably implies that about the year 1500 the book was in London, where indeed it is likely originally to have been written. That it was not the copy used by Caxton is shown by the fact that the two texts are complementary—that is to say, the manuscript corrects Caxton's mistakes and his text corrects mistakes made by the manuscript's copyists, which, unfortunately, they took very little pains to correct themselves.

The most interesting feature of the new text is undoubtedly the proof it gives that in one long passage, Book V according to Caxton's divisions, Caxton entirely rewrote Malory's work. The reason for this is plain. Malory based his account of the Roman expedition of King Arthur on an early alliterative poem written perhaps a hundred years before. A version of this

(probably not as it now appears precisely the version which Malory used, but certainly very close to it) has survived in Lincoln Cathedral Library, and a comparison of the two shows Malory following his original with surprising fidelity, though he considerably reduced its length and modified the narrative in various ways. The result is a passage of notably archaic flavour, with a jingle which Caxton no doubt considered unsuitable for prose and with many obscure words and phrases which he may well have thought his public would not understand. He therefore rewrote this passage himself in a style markedly influenced by the new classicism of his day, and it was of course his own version that he printed and which has been considered up to the present as Malory's work. The Winchester manuscript therefore gives us a very substantial new passage of Malory's own writing (a most valuable addition to our knowledge of his literary work) and also identifies for us a hitherto unrecognised passage of Caxton's prose.

The prosaic Caxton.

A few examples may be given to illustrate these points. Many of the phrases in Malory's account (as given in the new MS. text) of the wicked giant in Book V are lifted bodily out of the old English poem :—" as thou art rightwise king, rue on thy people " ; " I had lever I had been before that freak, a furlong away " ; " two fires he finds flaming full high " ; and scores of others, while Malory's own language catches the alliterative habit, so that he writes of the " burliest knights that ever brake bread " or " Sir Bors and Sir Bevel were foremost in the front and freshly fought." Malory's description of the wicked giant is worth quoting in full :—

> " The glutton glowered and grieved full foul ; he had teeth like a greyhound, he was the foulest wight that ever man saw, and there was never such an one found on earth, for there was never devil in hell more horrible made ; for he was from the head to the foot five fathoms long and large ; and therewith sturdily he started up on his legs and caught a club in his hand all of clean iron."

Caxton has reduced this description to the phrase, " the glutton anon started up, and took a great club in his hand." Similarly a magnificent descriptive phrase, " a gay knight all flourished with gold," becomes in Caxton simply " a knight," and the revision throughout this book, except in Chapter IV which tells of the Dream of Arthur, has been on this drastic scale. The contrast between the material which has been excised and Caxton's own writing is most noteworthy. " Ambassadors and Messengers from the Emperor Lucius, which was called at that time Dictator or Procurer of the Public Weal of Rome," " that noble empire which domineth upon the universal world," are typical examples of the latinity of Caxton's style.

" Improving " the Text.

The new version of Book V is not the manuscript's only contribution. It shows that Caxton revised the text throughout with a view to modernising its language and smoothing some of the roughness which sometimes marred Malory's style. This often amounts to very little, and there are many passages which Caxton printed almost untouched as he found them in his copy ; but occasionally his eye lighted on a paragraph which he did not like and which he therefore revised more freely. Caxton, whose output during the years when he worked in England was astoundingly large, was evidently a rapid but somewhat careless worker, and his method of revision as it can now be studied by comparing the manuscript and printed versions, illustrates this very clearly.

In printing the *Morte Darthur* Caxton reduced or sometimes entirely omitted the footnotes or colophons which Malory added to many of the sections of his work as he completed them. These are given in full by the manuscript, and they are a very welcome addition. And one is of special interest in that it speaks of Malory as " knight prisoner." In conjunction with other pieces of evidence this enables us to say that almost all the *Morte Darthur*, like another magnificent English book, *Pilgrim's Progress*, was written in prison. It further makes almost certain the identification of Malory the author with Sir Thomas Malory or Maleore, of Newbold Revel in Warwickshire, who died in 1470 and who, as we happen to know, spent much of the later part of his life in prison—apparently for choosing the wrong side in the Wars of the Roses. Hitherto this identification has been conjectural, and several other Malorys have been suggested.

A Polyglot Classic.

It is not often that a new translation of an economic work is undertaken nine years after its first publication. That has happened, however, in the case of Sir Ernest Benn's classic — *The Confessions of a Capitalist.* The publishing house of Meulenhoff, of Amsterdam, has just issued *Bekentenissen van een Kapitalist,* the translation having been undertaken by E. C. van Dorp. There are now very few European languages into which this book has not been translated.

A Forgotten City.

By W. F. Wright.

Within the last few years the ruins of the ancient Greek colony of Pæstum have been thoroughly explored, thanks to the activity of the Magna Græcia Society. The present article gives a vivid idea of the majestic beauty of the temples, the most impressive relic of Greek civilisation in Western Europe.

AWAY to the south of Naples, its northern limit about thirty-five miles from this town, stretches a great semi-circular plain. Its diameter is the sea and a sandy beach, its circumference encircling mountains. Centuries before Rome had become a city, Greek colonists from Sybaris, pushing up from the South, came upon this fertile plain, and here, some time between 650 and 600 B.C., they founded a city and called it Poseidonia. They prospered and the city grew. The rich plain around them and their trading between the Greeks to the south of them and the Etruscans to the north brought them wealth. Herodotus speaks of the city as already flourishing in 540 B.C.

In their prosperity these Greeks did not forget their gods. Three temples, examples of the best and purest in Doric architecture, remain to this day to bear testimony to their devotion as well as to their wealth. Round about 560 B.C. the first of these was built. To whom it was dedicated is unknown. To-day it bears the quite inappropriate name of the "Basilica." Squat in comparison with its more beautiful neighbour it yet has much beauty in the harmony of its lines and the taper of its pillars. Close beside the Basilica, about 450 B.C., they built a larger and more magnificent temple and dedicated it to Poseidon (Neptune). Its pillars are higher than those of the Basilica, 29 ft. as against 20 ft.; they taper less although still markedly; their capitals are less abruptly curved; they are more widely spaced. Thus the building, although still massively impressive, has a lighter and better balanced appearance and shows the progress which had been made in the Doric style of architecture. Farther north is a third temple, called that of Ceres. Built about 500 B.C., it shows a style intermediate between the other two, more slender than the Basilica, but as a whole less harmonious, though loftier, than the Temple of Neptune.

The east end of the Temple of Neptune at Pæstum.

These temples, the most impressive group outside Greece, are all three orientated east and west. Before their east ends were placed altars for sacrifice; the bases of these can still be seen. All three are built of a porous concretionary limestone—travertine—the many holes in which were once hidden by the layer of plaster that covered all. To-day all plaster, all decoration, all wood-supported roofs have disappeared. Statues and treasures have either vanished or lie buried. In these temples, once thronged with crowds of worshippers, grass and flowering weeds grow in the interstices between the stones, lizards scuttle away beneath one's feet, and flocks of birds dash off at one's approach while crows fly croaking overhead.

Already in the 5th century B.C. trouble had fallen on the city. The Lucanians, having broken away from the Sabelli who had occupied Campania, crossed the Silarus which flows across the plain of Pæstum and attacked the city. By 400 B.C. they had subjugated it, but they did not destroy it. They made it their capital and built up around it a state which united all the peoples of Southern Italy. And, except for a temporarily successful insurrection of the Greek peoples, Poseidonia, now renamed Paistom, remained a Lucanian city till the Romans, expanding southwards, came upon it. The Samnites already subdued, Rome turned her attention to the Lucanians; Paistom was captured and the Romans established a colony here in 273 B.C.

Under Roman rule the city, now called Pæstum, rose to even greater wealth. Amphitheatre and forum, new temples and roads were built, trade and agriculture prospered—Virgil tells us of the "twice blooming roses" which flourished on the plain. And through days of trial and stress the city remained ever faithful to Rome. She even supplied men, ships, and money for the wars against Carthage. The fall of Rome and

The "Basilica" and Temple of Neptune from the east.

the disintegration of the Empire brought disaster to Pæstum; and natural causes hastened its destruction. At the mouth of the Silarus—now Sele—a little north of Pæstum, a bar had slowly formed, and the constant overflowing of the river and flooding of the plain brought ruin to crops and farms and turned fertile fields into marshes and lagoons. In 871 the Saracens sacked the city now but poorly defended. Then from the pools of the half-dried floods on the plain came mosquitos and malaria, and the whole site became slowly an uninhabitable swamp. By 1100 the city was completely deserted. Its walls were overthrown, its houses destroyed, its streets covered with débris and sediment. Where had been a flourishing city was now a desolate waste.

The temples, empty and forgotten, stood surrounded by shrubs and swamps, unknown for generations, as if

The Forum, discovered in 1921, *with the temples behind.*

they had never been. It was not till the 18th century that their existence again became known. But oblivion had saved them from destruction. No mediæval lord made of them a quarry from which to build his feudal castle. And so to-day these temples, roofless and flower-grown, with wild birds nesting in their caves, survive. Through the temple of Neptune one can still catch a glimpse of the sparkling sea, and though sculpture and roof decoration and painted stucco are no more, harmony and beauty of outline and curves which give life to geometrical forms remain and an age long past lives on in beauty of its own creation.

An Attractive Journal.

The current number of the *Hong Kong Naturalist* is as full of interesting material as usual. Dr. G. A. C. Herklots, the indefatigable editor, continues his two admirable series on the Birds and the Orchids of the island, the former illustrated by a fine coloured plate of the Chinese Green or Eastern Yellow Wagtail (*Motacilla flava taivana* Swinhoe), by A. M. Hughes, the latter by photographs and line drawings. Facts and theories of great ecological significance are embodied in an article on The Relations between Flowers and Higher Animals, by L. van der Pijl, of especial interest being the way in which American humming-birds adapt themselves to introduced Asiatic flower species, and Asiatic sunbirds to American species. The relation between bats and flowers still demands investigation. Why, for instance, are bats apparently attracted to dingy and malodorous plants; and is it pollen or honey that the bats are searching for in their nocturnal visits to flowers?

Particularly engaging are the photographs illustrating the article, by Roy A. Pereira, on the bringing up by hand of young francolins (*Francolinus pintadænus pintadænus* Scopoli). Mr. Pereira took immense trouble to rear this interesting family; his efforts were *not* ably seconded by a domestic hen whose services were enlisted.

Historians and archaeologists are provided for by the readable Notes on Early Hong Kong Natural History and on Archaeological Finds on Lamma Island (continued). A lavishly hachured map of Hong Kong, published in 1845 (the earliest known), shows the expected changes in the name and lay-out of various settlements, but the account of the insalubrity of the island in the early days of the 19th century will come as a surprise to many readers.

The co-ordination of so many aspects of nature within a limited area makes the *Hong Kong Naturalist* a model which might well be followed in communities less remote from what Europeans are too apt to consider the centre of human culture. Printing and production are clear and unaffected, and, just by way of makeweight, two vigorous drawings of local sailing-craft are thrown in at the end.

Silver Foxes in Britain.

By Cyril Hopwood.

Late of the Imperial Forest Service.

Silver fox farming has attracted much attention of recent years in Britain. Mr. Hopwood here gives some interesting details of the development of the industry and tenders excellent practical advice to the intending fox-farmer; he will be glad to answer any queries on the subject addressed to him at the office of this journal.

FEW furs enjoy a greater measure of popularity than those of the silver fox, a popularity which is due to the great beauty of the skins, and to the fact that their price, though often high for superb specimens, is never prohibitive, as in the case, for example, of chinchilla. It is not surprising, therefore, that, with the demand in excess of the supply, attention has been directed to the possibility of breeding the animals in captivity. The first experiments were made about 1860 by the late Lord Strathcona on Anticosti Island, and some thirty years later the foundations of the present industry were successfully laid on Prince Edward Island. In the year 1920 silver foxes were successfully introduced into Great Britain at the Snowbelt Fur Farms, Alness, Col. the Hon. I. M. Campbell being perhaps the leading spirit. The idea rapidly caught on, and since that date numerous fur farms have been established, and are now flourishing in practically every part of the British Isles.

The silver fox of the furriers' shops is not a distinct species. It is, like the black leopard, simply a melanistic, or black, variety of an animal which is naturally of a tawny colour. In this case, the animal is the North American red fox, known to science as *Vulpes vulpes pennsylvanicus*, a geographical race or subspecies of our own common fox, *Vulpes vulpes*.

Although albinos of the red fox exist (there is a beautiful specimen from Siberia in the Natural History Museum), the white fox of commerce is not an albinistic variety of the red. It is, as a matter of fact, a distinct species, the lovely white fur being the winter coat of the Arctic Fox (*Alopex lagopus*), just as ermine is the winter coat of the stoat.

Dinner time on the fox farm.

Many of the foxes are as tame as they are valuable. Here is one of a pair of foxes valued at £125.

In the case of the silver fox, it has now been proved beyond all question that the black coloration from which the pelts derive their value in the market can be maintained permanently by scientific breeding. The "cross fox" of commerce is likewise a melanistic product of selective breeding. The name refers to the black cross on the animal's shoulders, and does not imply a "crossed" origin. Such foxes are not the result of mating silver (*i.e.* black) foxes with the common red. Most breeders do not trouble much about trying to produce cross foxes, as there is no certainty as to what the result will be, whereas the black variety can be reproduced with absolute certainty. Moreover, the pelt of a cross fox will not realise as much as that

of a silver unless the markings are unusually handsome, probably only about one or two per cent. reaching a really high figure of value. From this it is clear that those who are considering investing their money in silver fox farming will be well advised to stick to the pure blacks, and they can rest assured that, provided they start with guaranteed pedigree stock, the litters will be of the true silver type.

In November last I had the pleasure of visiting the ninth annual show of the Silver Fox Breeders Association of Great Britain and Northern Ireland, and was shown round by an old friend, Mr. J. M. D. Mackenzie, the chairman of the show committee, to whom I am indebted for much of the information contained in this article, as well as for permission to publish the photographs illustrating it, which were taken at his place in Perthshire.

Vulpine Aristocrats.

The foregoing may suggest to readers that it is essential to go north in search of a suitable site for a fur farm, but this is by no means the case. Provided that the original breeding stock is first class, fur produced on Dartmoor is every bit as good as that produced in the north of Scotland, though in selecting a site it is desirable to avoid a mild and relaxing climate, such as the southern seaboard. But fur of the highest grade can be produced, and is being produced, practically all over Great Britain, as was evident at the show referred to above, which contained exhibits from some forty different farms ranging from Scotland to Devonshire. Nearly 300 foxes were benched, each of which was a registered pedigree animal, and at a rough estimate they represented an aggregate cash value of between £15,000 and £20,000. Probably no animal exhibited was worth less than £60, and I was informed that some of them could not be bought for £200. This is not to say that their skins would fetch anything like this figure, the value of the show animals being based upon their pedigrees, and upon their proved capacity to produce litters of the highest grade.

Hard Work and Enthusiasm.

It is not to be assumed, however, that fox farming is a short cut to easy money. Like most other things that are worth doing, it entails a great deal of hard work, and it is inadvisable to embark upon the enterprise without a reasonable amount of capital. Those, however, who are in the happy position of possessing the necessary capital and enthusiasm can look forward with considerable confidence to a very good return for their investment.

The average litter per annum is from three to seven cubs, the normal average being about four, and with good management the mortality among cubs is very low. As the stock increases, in addition to the annual sale of pelts, there will be sales of live animals, which realise a very much higher price than do their skins. The price of a good pair of pedigree animals is about £100 to £125, and whereas the man embarking upon fox farming will have to pay this for his original stock, he can reasonably expect that within a few years he will have pairs to sell, and the receipts from these will materially enhance his annual profits.

Always provided that the vixens are well fed and cared for, Nature endows them with the ability to bring up their own litters, however large these may be. In the event of a mother-fox dying, litters can be successfully raised by cats, which have proved to be excellent foster-mothers. Foxes require much the same food as dogs: meat, which is usually given raw, porridge, fish, fox biscuits, and various meals, while the vixens and cubs are given milk and eggs.

In conclusion, I would emphasise the fact that it is essential for the novice to go through a course of training on one of the established farms, and I am given to understand that the leading farms arrange for this when animals are purchased from them, and that, for a reasonable fee, animals so purchased will be ranched and tended by the vendor whilst the newcomer is learning the business, and until his own farm is ready to receive them.

Inland Water Survey.

THE British Association has now published the Second Report of its Committee, appointed to inquire into the position of Inland Water Survey in the British Isles, and the possible organisation and control of such a survey by central authority.

The Report was presented at the Aberdeen Meeting in September and it reviews the work done during the year in collaboration with the Institution of Civil Engineers. This work culminated in the presentation of a joint memorandum to the Prime Minister by the Councils of the British Association and the Institution of Civil Engineers and in a deputation being received by Sir Hilton Young on July 17th. The Report recites the substance of this memorandum and the official report of the deputation's meeting with Sir Hilton Young. The careful consideration which His Majesty's Government promised the deputation to give to the organisation of Inland Water Survey has now resulted in the statement made in the House by Sir Hilton Young on December 7th.

Mr. Dunne's Serial Universe.

By A. S. Russell.

Mr. Dunne's theory of Serialism, expounded in his recently published book, attracted a good deal of attention in both the scientific and the lay world. Dr. Russell deals dispassionately with this attractive theory ; the problem is not perhaps so simple as Mr. Dunne would have us believe.*

When Mr. Dunne's earlier book "An Experiment with Time" came out more than seven years ago it attracted wide notice and received much praise. The "experiment with time" was really a claim that in certain stated circumstances the future could be quite definitely foreseen. Such a claim—if it could be proved—was, of course, exciting. The future which could be foreseen was not the future of the world generally, or of something in particular you might wish to foreknow, but the immediate or near future of your own self. The prediction or foreknowledge might be arrived at by a simple technique based on paying attention in the morning to what had been dreamt the night before. Mr. Dunne arrived at this original and rather startling view from a remarkable series of coincidences between his dreams and the events of his own life following the dream happenings. Thus, one night he might dream of being in a boat on a lake and suddenly getting stung ; a few days afterwards he would find himself in a boat on a lake and, sure enough, be stung. Much more remarkable coincidences of this simple kind occurred and were recorded, and Mr. Dunne's whole point was that they were not coincidences but something more important.

Foretelling the Future.

He believed that the only simple and convincing explanation of his experiences was that in some sense the future had already happened, and that in certain states, such as the dream state, one of the selves that constitutes our personality could be ahead in time of our normal self, and contemporaneous with what the normal self rightly regarded as "future" ; that this self, somehow, could observe this future event and communicate reasonably clearly to the normal self what it had observed. Thus it could happen that the future—one's own future—could be foreknown or predicted. The essence of the explanation was that there was more than one order of time. Different selves of the personality might exist in these different times ; the future of one self might be the "now" of another. The book contained the powder of a scientific theory called Serialism, worked out by Mr. Dunne, along with the jam of these personal experiences and explanations.

* *The Serial Universe.* By J. W. Dunne. (Faber and Faber, 10s. 6d.)

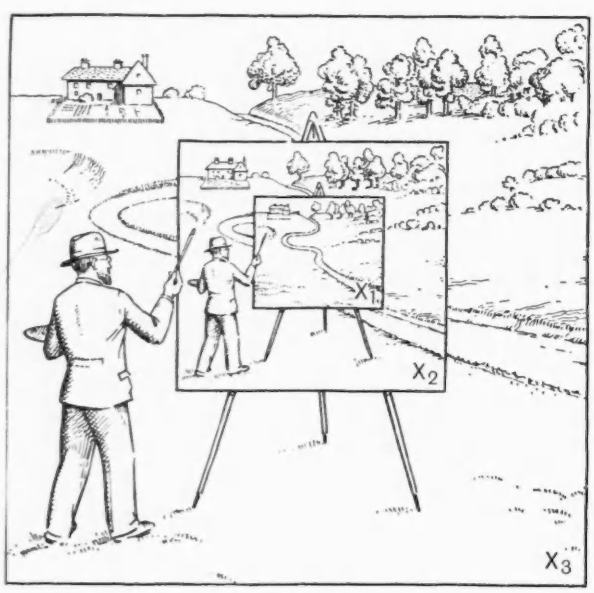
Although the theory was engagingly expounded in simple, almost non-mathematical terms, it did not capture the imagination of the readers as the experimental work had done. The most enthusiastic readers were the reviewers, who seemed to have been selected much more for their fame as imaginative writers than for any claims to be authorities on that great subject of science and philosophy—time. They expressed their appreciation of the book with a joy that seemed to sober readers a little exaggerated. One got the impression that nothing could be mentioned in the same breath with these experiences since the scalpel had fallen from the tired hands of Darwin, or, maybe, since the philosopher Kant had gazed for the last time on the church steeple at Königsberg. More conservative critics contented themselves with asking for more. They liked Mr. Dunne's charming way of exposition, his desire to be honest, his enthusiasm for his cause, but they felt that all was not so simple about the future as Mr. Dunne might think. They felt that the truth or otherwise of the experiences was the chief issue at stake, and that any theory about them, be it Serialism or not, might very well wait till the experimental work was firmly based.

So much, I think, should be said before the new book is discussed. This is concerned almost entirely with the theory of Serialism—a continuation, development and application of the theoretical part of the earlier book. Those of us who had hoped for further and confirmatory experiences are disappointed, but we agree we have no right to complain. An author has the right to produce the book he wants to, instead of the book both admirers and critics would have liked to have had from him.

Serialism the Solution?

Mr. Dunne believes that his theory in its developed form not only can explain why the future may be accurately predicted but also can solve, or help greatly to solve, some of the more obdurate difficulties and outstanding paradoxes of modern physics. He believes that much of these difficulties arises from a failure on the parts of scientists and philosophers to think out clearly what they mean by self-consciousness and by time. They have accepted these things far too superficially and been misled by not pushing their analysis of

them deeper. Personality and time are each examples of what he calls an "infinite regress." They are a series of personalities and a series of time orders which are altogether richer in content and in potentiality than the single personality and the single order of time which most of us content ourselves with assuming when we think of these things. (These are but the "first terms" of the infinite series.) An idea of an infinite regress may best be given by a paraphrase of Mr. Dunne's own illustration. An artist painted a picture of the landscape before him and realised when he had done that he had left something out: he had not put himself in. So he painted a second canvas showing in the foreground himself painting the first canvas of the landscape. But this painter painted was merely the painter painting, not the painter as observer and other things. So a third canvas was done showing both the second and the first canvas. But this, even, did not satisfy him that he had really painted himself painting the landscape. On the other hand, it had revealed to him merely that his-self number two had painted his-self number one; neither nor both was really *him*self. He felt he would have to go on painting picture within picture for a very long time really to get himself into the picture. It is clear, I hope, that this kind of infinite series—an infinite regress, as it is called—is a richer thing than its first term—the landscape first painted; but it is understandable that if the thing considered—as the landscape in Mr. Dunne's illustration—was a difficult one, most people probably would not push their thinking beyond this first term. They would probably be glad enough to get as far as that; there they would be content to remain; they would leave to others the visualisings involved in the intricacies which accumulate as one plunges down the infinite regress.



Artist and Picture.
(*By courtesy of Messrs. Faber & Faber, Ltd.*)

In this complex medium, however, Mr. Dunne is quite at home. He thinks, as I have said, that both personality and time are examples of this infinite regress. "You" is not just what you very probably think "you" is. Like the rest of us you may have not gone beyond the first term in thinking of yourself. According to Mr. Dunne the "yous" that make up "you" go on for ever. And so with time. We think there is just one order of time, namely, that in which the events of our lives occur; Mr. Dunne believes there are many. Each of the selves in the "infinite regress" which constitute our real selves, each of the observers constituting the self-conscious human being, has his own time order. For them time is not just one dimension like length or breadth or height or even three dimensional like space; it is multi-dimensional, more complex therefore, relative to our simple idea of time, than is space to a dimension like length. We are all agreed that the "moving present" is the essential feature of Time. Mr. Dunne argues that this very movement itself takes time, so that there must be a second order of time in which such movements are timeable. And this time, he goes on, involves another order of time, and that another, that another, and so on for a very long way. He assists his readers to grasp the significance of these different time orders by arguments and devices used by mathematicians in the study of dimensions, and by some interesting diagrams. He writes engagingly. The plain man of science, unused to frills, might think he writes too engagingly. Mr. Dunne is poles apart from the dry-as-dusts who care not whether of no what they write is read. He writes like a pre-war army man, with a gift for speech, anxious to explain something quite fairly technical to men in armchairs. Scientists who rightly set greater store on basic postulates and a minimum of woolliness in exposition, than on clever phrasing or happy analogy, will not like the book so much as the public to whom it is primarily addressed. Nor will they care for the harmless humour which calls an artist invariably a tame lunatic, or phrases like that, and never calls a thing pure without adding that it is also undefiled or unadulterated.

Having expounded the essence of his theory Mr. Dunne extends it to the spheres of physics, philosophy, and psychology. He attempts to show that it provides

a simple resolution of some problems hitherto regarded as insoluble. He expounds, for example, the regress of relativity and makes brave raids into the domain of physics where quanta, waves, and particles, the very bases of the world of matter, are at present causing difficulties. He sees in relativity, the effects of wave-particles, and in the quantum itself, not all the difficult things physicists find them but examples of the fact that a time picture is necessarily a " regressive " one, and one which could not be initiated except by a " regressive " observer aware of a travelling " now." The " uncertainty " of Heisenberg's now famous principle is found to be regressive and located in the instruments of observation instead of in the world observed, which remains determinate, and Minkowski's " imaginary " time appears when the axis of " second-term " time is rotated through a right angle into coincidence with that of " first-term " time. All this is very technical, but although deep things are discussed the discussion is kept pretty general. There is no working out of anything quantitatively. The constants of nature are not shown to be capable of being satisfactorily calculated from anything in the theory. Quantitative is the only kind of treatment those who take an interest beyond mere curiosity in these subjects want. All these high matters of physics, as a fact, happen not to be matters that can be settled by anybody, or by any body of men, in a few short chapters of popular exposition. Any one who really did a quarter of the work which Mr. Dunne thinks he has done in the third part of this book would be hot favourite for a Nobel Prize. There is no doubt of that. With all his disarming deprecation of himself, Mr. Dunne thinks he has done a good deal. We read about " evidence bearing out completely the conclusions arrived at," of time-pictures fitting " perfectly the tables of the self-conscious observer " and so on, but few hard-bitten scientists will share this optimism. They will agree, however, that Mr. Dunne is a man of ideas, that he has great powers of convincing expression, and that this new book of his is a contribution to originality. What can be said in criticism of it ?

The Two Meanings of Time.

Two things, straightaway. First, the treatment of " serial " existence, while brilliant as a *tour de force*, is an unwarranted deduction from observation. Because a man is conscious he is conscious . . . is no ground for postulating an observer, observed by an observer, observed by an observer, . . . and so on infinitely. And if this series of observers, each behind the other, is denied, the denier gets very little to bite into in this book. One can of course assert that this series of observers exists by straining the meaning of " observer " and " existence," but there is no convincing proof of it. Second, it is unwise of Mr. Dunne to think of time as multi-dimensional. Time is constituted by the moving present, but there is no evidence that this movement of the present takes time (any kind of Time, whether with a small or a large t) so that there must be a second time in which movements are timeable. Time is only known by events. Orthodoxy declares there is only one, absolute, unchanging order of events. There are no second, third, fourth, and so on, systems of events available for the second, third, fourth, and so on, orders of time in which Mr. Dunne believes, except, of course (and no sarcasm is intended), in imagination. It is really difficult to follow Mr. Dunne when he talks of time being multi-dimensional ; yet, at the same time, it is harder to be sure one is right in criticising his views on this subject. For although time in its capacity as one of the four dimensions of the space-time continuum (in which, on the best available evidence, the events of the material world are supposed to happen) seems no more mysterious than length or breadth or height, it is in our consciousness much more mysterious. We all recognise that. It is harder to be right about time than about space. It is usually supposed that those like Mr. Dunne who have been led to believe in an infinite series of times have been misled by failing to distinguish between the two meanings of time : time as percept and time as concept. Time, implying the moving present, is perceptual in character. But time is used also to mean the whole range through which a moving present has moved, is moving, and will move. It is a concept which denotes all events, past, present, and future. But these uses of time, now in the perceptual sense now in the conceptual, are plain and understandable ; that time is very different from the multi-dimensional time of Mr. Dunne, which seems to the orthodox an unnecessary complication. Space, however, has been left by him in its simplicity ; it has not been subjected to the infinite regress and for the best of reasons ; it would soon land the thinker into absurdities. But a good relativist with a fondness for debate would want to know why space gets off in this light way. To him there should be no formal distinction between space and time, for they are not now believed to be separate absolutes, as Newton thought, but just aspects of one absolute—space-time—despite our intuitive desire to keep them separate in thought.

The Orthodox Reaction.

These criticisms are those of the orthodoxy of the present. Mr. Dunne may reply, " Blow orthodoxy ! This is an original book. Read it." The reader will

undoubtedly be stimulated by the book, but his main interest in the novel views in it will be not what he thinks of them but what contemporary science thinks. It is unfortunate for Mr. Dunne, although he has lectured to expert audiences on his work, that the strait-laced in science and philosophy like all contributions to their work to be addressed to them in the learned periodicals. A popular book, however well meant, is no vehicle for the epoch-making advance. If the experts are to be convinced they have to be wooed in their own way. What matters about Mr. Dunne's theories is the place they will take in the main stream of scientific and philosophical thought.

Whatever be the fate of his views Mr. Dunne has done good service by focusing public attention on two interesting philosophical problems: time and the future. No reader of his book will ever think of these subjects again as he has done in the past. There is more "fun" about them than he has ever thought. And, maybe, as Mr. Dunne thinks, there is a good deal more.

The Origin of "Britannia."

The winter issue of *Antiquity* is largely devoted to the Roman period. Sir George Macdonald deals with Rome in the Middle East, and Mr. J. N. L. Myres and Dr. Mortimer Wheeler cross swords on the topography of sub-Roman London. Mr. Harold Mattingly, of the Department of Coins and Medals in the British Museum, traces from Roman days the history of the figure of Britannia, familiar on our bronze coinage. This Britannia, be it noted, has openly "ruled the waves" only since 1799.

"In depicting Britannia in human guise," Mr. Mattingly writes, "the Romans were only obeying a deep instinct of their nature. Personification to them was vital and significant—no frigid convention of literature and art, as it is so often to-day. To the Roman's religious sense there were divine powers behind all the multitudinous phases of life, to whom it was appropriate to offer prayer and sacrifice when their province was in question. Following on this line of thought, the Roman found it natural to conceive of every land as having its own divine protector—whether called by its own name or described as its 'Genius' or spirit. Here the process of personification was often left only half complete. Roma and the Genius of the Roman People were, no doubt, recognised deities: but the province would have, at the best, a local cult and, outside its own area, would be only half realised as a living person.

"That Roman interest in the provinces, from which our coin-types spring, begins in the first century of the Empire: it only reached its full development in the second and third. On the coins of Hadrian Britain is a female figure seated with spear across left arm and huge round shield with central boss at her side. Antoninus Pius, on his sestertii, appears to show not a female, but a male figure, wearing breeches; he holds a standard in his right hand, while his left rests on a round shield set on a helmet. Up to the last there is uncertainty both as to the garb and to the attributes of Britannia—an uncertainty that suggests that to the Romans as to us she was an object of the imagination, rather than a fully realised goddess."

The Britannia type in modern times shows a similar uncertainty. The gracious woman of the halfpenny of Charles II, said to be a portrait of Frances Stewart, Duchess of Richmond, is a Britannia who combines the emblems of war, spear and shield, with the Branch of Peace. On the penny of George III (1799) the spear gave place to the trident: the emblem of Neptune was now for the first time claimed for the island kingdom.

Early in the reign of George IV (1825) were evolved the Britannia types familiar to us. The goddess retained the shield and the trident, but was now set towards right instead of left, and received a helmet on her head. She is now quite unlike any Roman conception of Britannia and is distinguished from a typical Roma only by the trident in place of spear and the cross on the shield. This Britannia is gracefully conceived and designed in the classical tradition: the worst one can say of her is that that tradition is neither native to us nor vital to-day.

The Verrall Supper.

THE late Mr. G. H. Verrall of Newmarket, the eminent dipterist, gave a very liberal interpretation to his duties as a member of the Entomological Club, a social institution which is older than the Royal Entomological Society of London. In 1887 Mr. Verrall invited not only his fellow members, but all his friends who were interested in Entomology, thus establishing a tradition that was extremely valuable, for it enabled correspondents and friends from all parts of the country to meet and discuss points of common interest. When Mr. Verrall died, in 1911, it was felt that the tradition was too valuable to be lost, and it has been maintained by voluntary subscription. The Verrall Supper is held at the Holborn Restaurant every year on the night before the Annual Meeting of the Royal Entomological Society. Many entomologists travel long distances rather than miss the function, and the number of those attending grows every year.

Red Sea Fishers.

By Cyril Crossland.

Director of the Ghardaqa Marine Biological Station.

At the north end of the Red Sea, near the Biological Station of the University of Egypt, sea birds are not common, and land birds except the raven, which depends no doubt on human association for its food, are either rare or else seasonal migrants. The big sea-hawk, *Pandion haliaëtus* (really a kind of eagle), is thus the more conspicuous.

The sea-hawk's prey and methods of fishing are not those of a true sea bird. His adaptations for the sea amount to very little; the spininess of the under sides of the toes and absence of long feathers on the legs may be such, but he remains a hawk (or eagle) like others of his kind. Instead of swooping upon shoals of swift-moving surface fish as do gulls and terns, he generally can capture only slow-moving fish, such as the "Box fish" (*Ostracion*), the "Trigger fish" (*Balistes*), the "Puffer" (*Tetraodon*), and *Holacanthus*, a blue fish with a brilliant yellow patch often to be seen slowly nosing about coral reefs. The skins and bones of these fish are found in numbers about the eagles' nests.

Such fish by their behaviour show that they are protected against the usual predatory fish, though just how is not clear, but their devices leave them defenceless against two invaders from the land, the spear of the fisherman and the talons of the sea-eagle. The necessity for fishing with spears arises from the ubiquity of coral, which reduces the utility of nets very greatly, and even line fishing cannot be carried on where a hooked fish may take refuge among coral, whence neither it nor the line could ever be got free again. Consequently fishing by spear is prevalent, though I have known pearl-divers catch fish with their bare hands. The spear in common use is a piece of bar iron, half an inch to three quarters thick and up to 10 feet long, pointed at one end and with an eyehole at the other to which a line is attached. Two men work together in a dug-out canoe, one leaning over the side looking through a water glass, the other slowly paddling. Their main search may be for pearl oysters, but, should fish be seen, the spear is held with half its length or more immersed, then poised and thrown with so sure an aim that quite small fish may be taken. Naturally, slow-moving fish are most often struck, but strong swimmers, such as species of *Caranx*, of which the best known is the "dolphin," famous for the iridescent colours it shows when dying, are often taken too.

There are neither cliffs nor trees on the Red Sea coast to afford protection to eagles' nests. *Pandion* makes a heap of branches of the salt-loving plants of the flat desert shore, such as samphire (*Salicornia*) and *Zygophyllum album*, seaweeds, fish skins and bones, and any sort of flotsam. As the same nest is occupied and added to for years the mound becomes a conspicuous pillar; one near here is over six feet high, and another I knew well on the Sudan coast was occupied for at least fifteen years. The large eggs are strongly mottled with dark brown, the young are brown, and if disturbed scuttle out of the nest and crouch among the surrounding herbage.

Their safety lay in the solitude of the desert, and also in the Bisharins' objection to eating birds and eggs, but now the motor car has made the desert not the solitude it was, and it is pathetic to see birds still attached to a nest but a few yards from the road between the oilfields camp and the biological station. The islands remain, and will remain, secure for them I trust. One thing I have done has turned out to their advantage, namely, the setting out of beacons on the coral reefs, which are immediately used by the sea-hawks as resting places on which to eat their prey. This must extend their fishing grounds very considerably as, being hawks and not sea birds, they used to have to carry their fish ashore to eat it, whereas now they can use the beacons miles out at sea. A sea-hawk carrying its prey in its talons to a convenient perch is a common sight, the fish being always held parallel to the body of the bird, not crosswise in the obvious way.

An old sea-hawk's nest on the low coastal plain alongside the Red Sea.

One might think that ravens could eat fish when they had an opportunity just as well as can the sea-hawks, but apparently they cannot, thus emphasising the specialisation of the hawks in both habit and structure. The other day someone had dropped a fresh fish on the road and three or four ravens spent a considerable time pulling at it, but when next I passed I found they had succeeded only in pecking a hole in the fish which was by then dried hard. Yet they are of omnivorous habits, and ravenous hunger is the normal state of every desert animal. Ravens will eat dates readily enough if given them, though they can hardly see them more than once in a lifetime.

Saving the Chough.

By Eric Hardy, F.Z.S.

Though one of the rarer British birds the Chough is far from extinct; its continued existence in these islands is, however, jeopardised by the dangers of in-breeding. Mr. Hardy discusses the possible introduction of new blood from abroad.

Among the efforts that are being made to increase the numbers of the red-legged jackdaws, or choughs (*Pyrrhocorax pyrrhocorax*), that nest on our rocky western coasts, the introduction of fresh stock into the British colonies from the numerous birds of Brittany and Normandy is likely, and while many naturalists object to any scheme for introducing animals from another country into our own for reasons of scientific recording, even when such animals are not likely to become injurious, there are many who support the scheme. Since the war, attempts have been made to increase the numbers of three of our rarest birds, including the osprey and golden eagle, by the introduction of birds or eggs from other countries, while many English red grouse have been put down in Ireland, and Scottish black grouse in England, though attempts to introduce southern nightingales' eggs into northern robins' nests failed to increase the range of that favourite songster.

Prevention of In-breeding.

The Cornish chough, or red-legged daw, propably has never been a common British bird, but it is far more numerous in Britain to-day than some people are trying to make us believe, and at any rate there is no immediate danger of extinction. Some bird-lovers, however, deem it wisest to introduce Brittany birds to our western colonies to provide fresh blood, and this is a wise theory in so much as bird-lovers in their campaigns for bird-protection often overlook the physiological danger, among rare non-migratory birds like choughs, kites, and eagles, of in-breeding, which produces a deteriorating standard and hastens extermination.

The chough is confined to the rocky coastal cliffs, with one or two exceptions, such as a pair which has nested for the past six years in Snowdonia, in North Wales, and another pair which last year nested in an inland valley in the Isle of Man. The main nesting colonies of the chough in Britain are the cliffs of Cornwall and Devon, Pembrokeshire, the Isle of Man (where it cannot be called uncommon), and, especially, the west coast of Ireland. It is absent from the East coast, but nests in 172 places on the south-west Scottish mainland, and is maintaining its status in the Inner Hebrides, especially on Islay and Jura; and its nests occur also on the Channel Islands. Cornwall was once the stronghold of the chough, to which it was thought peculiar (whence its old name of Cornish chough) but it is probably rarer now in Cornwall (6-7 pairs) than in any other of its British haunts, and thus the misconception that it is in danger of extinction has arisen. It is the emblem of the Duchy of Cornwall and legend relates that its avian form enshrines the spirit of King Arthur:

> "And mark yon bird of sable wing,
> Talons and beak all red with blood,
> The spirit of the long-lost king
> Passed in that shape from Camlan's flood."

In the Isle of Man as many as forty nesting sites have been found in a recent season in Port Erin harbour, and there are other colonies towards Spanish Head and around Bradda Head, while in Scotland it still breeds regularly on the coasts of Ross and Ayrshire.

With notes rather like the cry of the jackdaw or the chatter of the starling, the chough is recognisable by its black body—two inches larger than a jackdaw's—glossed blue and violet, and its fairly long, orange-red legs and long, decurved, orange-red bill. It feeds largely on grubs, berries, and grain in the fields near the cliffs, and occasionally on carrion. It sometimes indulges in erratic flying antics, and can run very well over the rocks, appearing from a distance like a rook rather than a jackdaw.

Some Foreign Relatives.

In the Alps and many European mountain ranges, the Cornish chough is replaced by the Yellow-billed Alpine Chough, a bird once commonly imported to Britain as a cage bird, one or two of which escaped and were shot as rare birds, though they never nested here. In Central Asia occur also the chough-thrushes, which, with the huias, link the choughs with the birds-of-paradise. A camp established 20,000 feet up Mount Everest was visited by two species of choughs.

It should be insisted upon that French or other choughs introduced into Cornwall must be marked with aluminium rings to identify them, and record should be kept of the individual introductions; indiscriminate liberation, such as has occurred with certain foreign butterflies would make future scientific records of comparatively little value.

Ancient Trees and Modern Gold.

By Ralph W. Chaney, Ph.D.

Research Associate, Carnegie Institution of Washington;
Chairman, Department of Palæontology, University of California.

California has recently seen a renewal of the days of "forty-nine." The new gold rush, due to adverse economic conditions throughout the world, has had an interesting by-product. Dr. Chaney records some of the remarkable discoveries in palæobotany made last year at the gold fields.

CONDITIONS which cause factories to stand idle in many parts of the world, and which result in widespread unemployment, are responsible for the opening in California of gold mines which have been deserted for decades. With the opening of the mines there are uncovered, not only the nuggets and dust of precious yellow metal, but ledges of rock containing fossil leaves, fruits, and wood—less valuable in the markets of the world, but of great significance to the students of the Earth's history.

When gold was discovered in California in 1849, the foothills east of the Sierra Nevada became the objective of the pioneer band which made fortunes and romance, and laid the foundations for the development of this westernmost unit of the United States.

Certain episodes and conditions of the frontier are also reflected in such names as Brandy City, Hangtown, Poverty Hill, and Independence Hill. An area in Nevada County, ten miles east of the present city of Grass Valley, came to be known as You Bet, and its neighbouring gold camp was called Red Dog.

During the early mining days large pieces of petrified wood were stacked in rough heaps.

Fortunes were made—and lost—during these early days when by crude mining methods the yellow metal was readily washed from the gravels bordering the Sierra Nevada. Then followed more pretentious mining known as hydraulicking; by the use of huge, spouting streams of water the sands and gravels were washed away, leaving behind fragments of gold.

Fossil leaves of a fig, typical of specimens found in Nevada County. Modern allied species inhabit warmer latitudes in America and elsewhere.

When the white man had taken all he could from these diggings, the Chinese, who were always awaiting their chance, took over the task of squeezing from the earth the last of the golden grist. As recently as 1908 three quarters of a million dollars in gold were recovered by Chinese miners almost at the centre of the diggings at You Bet. The place is still called Tai Flat in honour of the Chinese foreman under whose direction it was mined, after the white miners had decided that all the gold had been removed. Recently came a change in gold values as a direct result of unsettled money conditions throughout the world. The price of gold shot up almost over night. Again it became profitable to work the California placer mines, and to-day they are filled with men, with streams of water, with excitement.

During the early days of mining at You Bet, and at many other diggings in California, large pieces of petrified wood were uncovered in the gravels. What annoyance the miners may have felt at having to move this petrified

Leaf of an Arabia, *one of the commonest fossil plants of the California gold deposits. The living tree is found in warmer American countries.*

wood, some pieces of which weigh many tons, was more than balanced by the fact that around these fossil trees the gravel was exceptionally rich in gold. Washed along the channels of ancient streams and deposited as driftwood, these tree trunks formed catchment basins where fragments of gold were lodged. Without realising that they were contributing to science, the forty-niners became collectors of fossil plants—involuntary palæobotanists. During the long ages since driftwood and gold were deposited together along the west front of the Sierras, the gravels and sands have been compacted into rock, and the tree trunks have been turned to stone. Here and there, where fine sediments were deposited, leaves and seeds were buried, and their impressions have been left—a chapter written before Man came to live upon the Earth. With the closing of the mines, discoveries of fossils became less frequent, and for many years there has been no addition to our knowledge of the ancient forests of this part of California. But with the revival of mining activity, new fossil-bearing layers have been discovered by the miners, and by Mr. H. D. MacGinitie, who is studying the history of plant life at the University of California.

Mr. MacGinitie reports the finding of more than forty kinds of leaves, including figs, magnolias, palms, sycamores, and avocados. Of these none have lived down to the present in the region of You Bet, although palms and sycamores occur in warmer parts of California, and some of the others grow under cultivation. These hills are now occupied by pines and oaks, constituting a forest similar to that found in many of the temperate areas of the northern hemisphere. The occurrence of trees in the fossil forest which are confined to warmer parts of the world at the present time suggests that the climate of central California has not always been as we know it. There is abundant evidence from the fossil plants here and in other parts of western America that the Pacific coast once had a climate similar to that of Mexico and Central America.

Nothing is known of the animal life at this time, but it may be supposed that mammals like those now occurring in the forests to the south may have lived here. It was long before the day of Man upon the earth—certainly many tens of millions of years ago—that there lived in California the trees whose fossil remains are found in the auriferous gravels.

London's Latest.

LONDON bus-conductors on the new "Q" type motor-buses are having a busy time dissuading would-be passengers from trying to board their buses at the usual place, behind. In these vehicles the main entrance is in front, beside the driver, as in many single-decker coaches already on the road, and there is an emergency

One of the new "Q" type buses of "London Transport," the latest to appear on the London streets. The most interesting innovation is the position of the entrance, which is now in front.

door at the back. With the total disappearance of the bonnet the "ghost of the horse" is completely laid, and the new buses acquire a compact streamlined outline. There is seating accommodation for 28 passengers on the lower deck and for 32 above, and the engine generates 120 H.P.

Book Reviews.

A History of Food Adulteration and Analysis. By FREDERICK A. FILBY, M.Sc., Ph.D. (Allen and Unwin. 10s.)

This book is a doctoral thesis approved in the University of London, which has been chosen for inclusion in the new *History of Science Library* edited by Professor A. Wolf—a double sponsoring that would seem to relieve the author of anything more than a merely accessory responsibility for its appearance in print.

In the first five topical chapters Dr. Filby endeavours to describe the history of practices of adulteration by grocers, bakers, brewers, vintners, and distillers, from the middle ages down to 1820—which he marks as the close of a period; for the most part he confines himself to the records of these trades in England, though he makes frequent excursions into the scientific literature of France, Germany, and Holland to procure testimony upon the various forms adulterations may take. So long a period, with a field so little previously studied, should have been recognised, during the earliest stages of the investigation, as large enough to furnish ample matter for a dozen or more of doctor's theses; and the failure to observe reasonable limitations of theme and period appears to be the initial cause of a thoroughly unsuccessful outcome of an immense amount of research. This first and inevitable shortcoming is accentuated by the author's deficiencies of historical judgment and technique. Each of the chapters upon the trades concerned presents the appearance of a succession of poorly connected paragraphs, written around some card extracted from a vast file of transcriptions, assembled by weeks and months of toilsome gleaning; the paragraphs do certainly follow in a roughly chronological order, but they seldom or never blend into any integrated and consecutive historical narration. And the existence and extent of actual practices of adulteration by the various trades are presented in such vague sentences as these :—

> " Mustard is mentioned as being adulterated with wheat flour, pea flour, raddish (*sic*) seeds, and cayenne pepper " (p. 45).
>
> " Cheese was not in itself liable to adulteration (save for stray impurities), but the outside was frequently coloured with annatto " (pp. 52-3).

The omission of references to the places and times of such practices—or even to the sources of information—are characteristic of the treatment. (And, as a further serious defect of scholarship, it may be mentioned at this point that the bibliography, though comprehensive, is very crudely compiled, since it omits the dates and places of publication of periodical publications, and records dates of translations and second or later editions of important works without indicating when and where original publication had been made.)

After the surveys of the five trades, there follows a largely irrelevant chapter entitled " Food Analysis, being the Beginnings of Organic Analysis," which chronicles the earlier developments, up to 1820, of the *chemical* analysis of organic substances, and yet entirely ignores the problem of determining the quality and purity of organic substances as human *food*.

In the introductory chapter, Frederick Accum was designated as the writer who finally brought the storm over adulteration in 1820, and whose book (*A Treatise on Adulteration of Food, and Culinary Poisons* . . .) marks the turning point in the story. The first six historical chapters of the book, therefore, all traversing the period prior to 1820, seem designed to lead on to a detailed account and critical appraisal of Accum's achievement, as the obvious and inescapable climax of the book. Nevertheless, despite the high importance he attaches to it, Dr. Filby passes on without even so much as mentioning the title of Accum's work in the text of his book, and concludes with a chapter on " Later Developments " *after* 1820, which even he perceives to be a gathering up of loose ends.

A few more of the serious faults of the book may be briefly mentioned. A long appendix purports to offer " a complete account of the Historical Statutes bearing upon the subject "; but it proves to be merely a string of citations of isolated clauses, which are worthless and meaningless when thus detached from their historical setting; and there is not the least endeavour to furnish any explanatory account of the development of legislation against adulteration, and its enforcement, even in England alone. Neither is there any recognition of the economic aspects of practices of adulteration, such as their apparent tendency to increase at times of war and scarcity, and to affect principally beverages and the more highly-priced flavouring foods.

The acceptance of this thesis depreciates the standards of graduate work in history in the University of London.

The Ideas of Physical Chemistry. By H. MCKAY, B.Sc., and H. A. C. MCKAY. (Heinemann. 7*s.* 6*d.*)

The real revolutionary change in physical and chemical ideas began at the end of the 19th century with the discovery of the electron and of radioactivity. Hitherto, chemistry and physics were two separate and distinct sciences. The chemist had introduced the idea of atoms and molecules because it was a convenient working hypothesis; he had no direct evidence of the existence of these minute particles, and definitely physical methods had to be used to work out how atoms and molecules were built up. The chemist treated atoms and molecules *en masse*; it needed physical ideas to deal with the behaviour of single atoms and single molecules. In this way a much closer co-operation came into existence between the chemist and the physicist, and it became possible to investigate the true structure of the atom. The first idea was one of electrons revolving round a small positive nucleus, on the analogy of the solar system. Then it was found that the positive charge on the nucleus increased from element to element, and that the properties of an element depended on the charge on the nuclei of its atoms. The existence of isotopes was therefore possible, and there was also a prospect of the transmutation of elements, a process which has since been accomplished on a small scale. With this knowledge of the atom, as pictured by the physicist, the chemist was able to investigate that particular problem of how atoms are linked together to form molecules.

The concluding chapter of this book, which deals with a general survey of physical chemistry, gives a very clear explanation of the course of events. Those who have hitherto regarded physical chemistry as a subject which is understood only by the aid of an extensive knowledge of mathematics and an extraordinarily unbalanced brain, will therefore turn, without hesitation, to the preceding chapters to learn more of this intricate framework upon which the whole structure of chemical knowledge is built. The authors give theories, facts, and implications

in language which is easily readable, and in a manner which will have a wide appeal.

We are told that the discovery of isotopes was one of the most exciting events in the history of chemistry, for it had always been supposed that all the atoms of an element were identical. That the atoms of an element might be of several kinds, differing in certain properties, became clear from a study of the radio-active elements, which possess the very interesting property of being able to change spontaneously into other elements. We are also reminded of the fact that it may seem strange that so many substances should have a crystalline structure, and that innumerable microcrystalline substances—which appear to have no shape at all—are truly geometrical in form if viewed under the microscope. When a substance crystallises it generally tries to pack itself into the least possible space, and so definite crystal structures arise. The nucleus is the foundation on which the crystal is built, and subsequent growth occurs layer by layer on this foundation. Each new layer starts at a corner or an edge of the crystal and then spreads over the face with great rapidity; in this way the edges of the crystals are kept sharp and the true geometrical form is preserved as the crystal increases in size. The subjects of stereochemistry, molecular spectra, photochemistry, adsorption and catalysis, and colloidal solutions, which occupy a few of the 27 chapters, are equally interesting and deserve to be read by all who desire to know something of the true meaning of "matter."

The Spirit of Chemistry. By ALEXANDER FINDLAY. (Longmans, Green. 10*s*. 6*d*.)

The first edition of this book appeared in 1930, but the original rough outline was made fifteen years earlier in a short course of lectures which were ultimately published under the title of *Chemistry in the Service of Man*. The plan of the text has been chosen to make appeal to the imagination and interests of those who are not destined for a scientific career, but who desire to understand something of the intellectual progress of recent years, and to gain some knowledge of a branch of science upon which much of our present-day civilisation is based. But while it is sought to give, in historical setting, some account of the more important discoveries and achievements in chemical science, and of the materials and chemical phenomena met with in everyday life, the real purpose of the book is to create a scientific spirit—hence its title.

The first three chapters deal with the aim and method of science; the twilight age of chemistry, in which is included the rise and development of alchemy; and the dawn of chemistry, where we are introduced to Robert Boyle, whose chief claim to fame rests upon the views which he expressed in *The Sceptical Chymist*, published in 1661. Lavoisier, Dalton, and Berzelius are the outstanding portraits in the chapter which deals with the fundamental laws of chemistry. Then comes Mendeléeff, who worked out a periodic classification of the elements. It was from a study of the atomic weights of elements known at the time that Mendeléeff was struck by the fact that a remarkable recurrence of properties was observed when the elements were arranged in the order of their atomic weights. A section on radioactivity and atomic constitution is followed by a study of the gaseous, liquid, and crystalline states of matter. The next chapter brings us to the work of Lavoisier, Priestley, and Cavendish in connection with the gases of the atmosphere. Further chapters cover fuels and illuminants, solutions, the relationship of electricity and chemistry, metals and alloys, acids and salts, the colloidal state, the rise of organic chemistry, and that most modern study, stereochemistry. Everywhere the setting is historical, and by means of portraits and biographical sketches the leaders in the development of chemical science are made to live in the mind of the reader as human beings rather than as mere names. At the same time Professor Findlay gives a very clear exposition of the fundamental principles and concepts arising from the work of these men.

Ronald Ross: Dragon-Slayer. By J. O. DOBSON. (Student Christian Movement Press. 3*s*. 6*d*.)

At a time when the spectre of malaria has again reared its grisly head, this book makes apposite reading. But for the untiring labours of Ronald Ross, malaria would be far less well understood to-day than it is, and Mr. Dobson's short biography gives an excellent idea of what manner of man it was who devoted the greater part of his life to the investigation of this scourge. Strangely enough, Ross was reluctant to follow a medical career; his own tastes lay rather in the direction of music and poetry; and his medical career, to begin with, was singularly uneventful. It was the sight of malaria-stricken sufferers dying by the thousand in India that set him on that road of research from which neglect and discouragement could not turn him.

Red tape snatched him away three times from malarial districts when he seemed to be just approaching the solution of his problem, and when at last he had succeeded in tracking down the *Plasmodium*, the parasite of the mosquito which is the true cause of the disease, he was faced with a chilling lack of enthusiasm both on the part of official authority and, it must be said, from the majority of his professional colleagues. Having spent the greater part of his life and his substance on malaria research, he ended his days worn out and poor, and recognition of his labours was at best half-hearted until after his death. August 20th is a day that should be kept in solemn memory in lands where the *Anopheles* was once the ruling power.

The earlier chapters of the book give an outline of the various mosquito-borne plagues, and Sir Malcolm Watson, of the London School of Hygiene and Tropical Medicine, contributes a sympathetic foreword.

Iraq Excavations of the Oriental Institute, 1932-33. By HENRI FRANKFORT. (Chicago University Press and Cambridge University Press. 7*s*.)

Dr. Frankfort's "Third Preliminary Report" as director of the field operations in Iraq of the Oriental Institute of the University of Chicago covers excavations on three sites, Tell Asmar (Eshnunnar), Khafaje, and Khorsabad, with two subsidiary "digs" in connection with the last-named at Tepe Shenshi and Jerwan.

Tell Asmar is one of the major sites in Iraq and its importance for the prehistory and chronology of Sumeria becomes increasingly evident as excavation proceeds. At the close of the season of which the results are here summarised, it had become apparent that the stratigraphical conditions, which it is possible to examine here over a considerable area, provide a continuous and unbroken series of deposits in a period extending from the Third Dynasty through Sargonid times to the age of the Royal Tombs discovered

by Mr. C. L. Woolley at Ur. Tell Asmar, therefore, in Dr. Frankfort's view provides irrefragable evidence to resolve the controversial problem of the dating of the Royal Tombs. A subsequent season's excavation has confirmed him in this view.

The excavations at Tell Asmar show that here at least the coming of the Sargonid dynasty of Akkad entailed no fundamental modification of the earlier culture. Further, and this is no less important, this site reveals for the first time in Iraq the complete cultural setting of life in early dynastic times, of which previous glimpses only had been obtained through the remains in temples and tombs. To these Tell Asmar has added a knowledge of the citizens' private dwellings. Here too, we see the first window and arched doorway.

Of Khafaje at this stage, there is little to be said, except that already it shows its close affinity to Tell Asmar, while at Khorsabad the most important result to be chronicled was the discovery of the now famous list of Assyrian kings.

Sails over Ice. By CAPTAIN "BOB" BARTLETT. (Scribners. 8*s.* 6*d.*)

"What a great gift it is, Sir, to couple the keen power of observation with the ability to remember what you have seen," writes Captain "Bob" Bartlett, and we can only agree with him after reading this account of *his* experiences in Arctic waters. And when this capacity for observation is linked, as it is here, with a gift for telling others, in appropriate language, what has been seen, the result is a highly interesting and informative piece of work.

Sails over Ice is Captain Bartlett's story of his ownership of the *Morrissey*, a sailing vessel constructed in the days of "iron seamen and wooden ships." He tells with graphic detail the adventures he has encountered in her on hunting, fishing, and observation trips—all in the most northern waters—stories humorous, tragic, and purely adventurous, but all told with a realism which makes the reader feel he, too, has encountered the cold blast of Arctic air, has heard the sharp report of the wind-filled mainsail, and felt the power of the boom's low, smooth swing.

Excellent illustrations accompany the text and add to the deep contentment of the reader at being before a warm fireside as he reads of hairbreadth escapes from toppling bergs; of facing possible shipwreck at the ebb of the tide; or of keeping awake for days in order to save the schooner's life.

The writer convinces us, in short, that "there is a great kick in being at sea again after a time on shore, to feel the wheel in your hands again, and the lunge of the vessel as she smashes along with a bone in her teeth, to know that every halyard, sheet and stay is good and true." "By God, Sir!" we say with the author, "there's nothing like it," and huddle deeper into our armchairs to read more of it.

Last of the Wind Ships. By ALAN J. VILLIERS. (Routledge. 15*s.*)

MR. A. J. Villiers has made a number of voyages in the big sailing vessels which still bring cargoes of grain each spring from Australia, and he has written about them before. His new book is primarily a book of photographs—more than two hundred of them—taken in the course of two voyages which he made in the four-masted barque *Parma* of Mariehamn, Finland.

These photographs are remarkable, more particularly because the majority of them were taken by the author with a battered second-hand Kodak 120, equipped with nothing more ambitious than a two-speed shutter. "If," he says, "we saw something that would make a picture we knew we would like, we tried to get it—if we were not otherwise engaged." The results could hardly be better. Here are pictures from aloft, from below; in fair weather and in foul; in calm and in storm. Here is the full beauty of masts and sails, and here the dangers and discomforts with which the crew had to contend. Arranged as they are in chronological order, these photographs give a good idea of life on a grain ship, and illustrate vividly the author's story of the *Parma's* voyage home in 1933. In that year she did the trip—Port Victoria to Falmouth for orders—in 83 days. "There had not been a passage like it in this century." She completed the voyage in nine days less than the time taken by her nearest rival.

But Mr. Villiers has done more than write the story of one outstanding voyage. He has provided a record, before it was too late, of something that is dying and will never be replaced. In 1921, 304 sailing ships visited Australia; in 1922 the number was 138; in 1933 it had fallen to 21. Last January there were only 49 deep-sea square-rigged trade ships in the world, and of those 16 were laid up indefinitely. England has none, and the majority of those in commission are Finnish, like the *Parma*. In five years, thinks the author, all may have gone; in ten years, certainly. Then, the full significance of a book like this will be appreciated. Even now it is a worthy newcomer among books about the sea.

Man's Genius. By E. BULLER BARWICK. (Dent. 3*s.* 6*d.*)

On its title page this book purports to be "The Story of Famous Inventions and their Development." Qualify the words "famous inventions" by alteration to "some famous scientific and mechanical inventions" and the title will suit the book. It is a fact that perhaps the most famous invention of all is the invention of writing: you will not find this described, nor will the origin of the violin, the piano, or the art of painting be disclosed to you. It is, however, unfair to suggest that the contents of this book are not roughly representative of the subjects that should receive attention, and when the book is regarded in the light of a volume dealing with Man's Genius applied to mechanics, it seems to fulfil its purpose. Yet the intending reader should be told that the word "invention" is not used here in its more literal sense. The author has taken pains to give historical outlines of the development of many scientific inventions of great commercial value, with special reference to those having their origin in the United States. There is certainly abundant information about American inventors both great and small. The former were inventors proper, the others might be described as keen improvers on the fruits of other people's brains.

The Romance of Engineering. By A. D. MERRIMAN. (Harrap. 7*s.* 6*d.*)

This substantial volume is written in the simplest and clearest fashion possible. Simplicity, in this case, is most particularly desirable, in that it should make the book perfectly understandable to almost anyone who can read. Yet one is perhaps apt to miss interesting details about various forms of machinery

described that might well have been inserted without causing unnecessary complexity. Take, for instance, the absence of details of the horse-power output of the early steam engines described: we read on p. 42 that Watt's "Old Bess" had a single cylinder of 33 inches diameter—usually termed bore—and a 7 foot stroke, but why no hint of the power output of this colossal cylinder when working at load?

It must be admitted that the choice of matter described under the various headings is skilful and sufficient. The subjects dealt with are: engines and power production generally; transport and engines applied to it; aeronautics—a vivid account of this science from the earliest times; the harnessing of Natural Powers; bridges and dams; and an account of the development of methods of steel production.

Each section is dealt with historically, from mythological and misty beginnings up to modern times. There are plenty of dates given to mark important events in engineering history, including the births and deaths of inventors. At the end of each chapter one feels a little regretful that modern achievement is so briefly dismissed.

This is obviously an excellent book for boys *sensu stricto* and for "grown-up boys" who have not already drunk their fill of the history of steam and power. The chapter on the steam turbine is very good and understandable, a short but lucid account of this modern apparatus. On the other hand, for the fancifully inclined, the little chapter on power from sunlight will prove very attractive—perhaps, even, it may inspire readers themselves to endeavour to propound new and practicable methods of utilising this greatest power of all. The problem is a tough one, for radiant heat is extremely difficult to collect and concentrate at a spot where it can be used.

Readers will find the book enjoyable, gently authoritative—and romantic. There is a large number of good, straightforward text illustrations, supplemented by numerous plates.

Westminster School. By LAURENCE E. TANNER. (Country Life. 10*s*. 6*d*.)

Mr. Laurence Tanner, in this volume, has achieved a fine success. Although quite early in life he has become, by means of Westminster, adjectival and substantive, almost a precinct in himself, he has produced a book which is authoritative but not fusty, readable but in the best sense an unexpected "thriller," and pedagogically condescending only in a very forgivable way.

If you idly pick up this book in a friend's drawing room, you will borrow it until you have enjoyed all its eighty-seven pages and its appended illustrations, whether or no you are interested in any small boy of 1934 or even of 1534, for it has the authentic odour of Westminster: the monastic clerkship of it; the Tudor *literae humaniores* of it; the Georgian episcopacy and judiciality of it; and the present-day tradition of it.

No bones are made of its decline a hundred years ago, and there is a brave indication that the lost ground is being made up. Up to the beginning of the last century, Mr. Tanner tells us, there were virtually only three schools for the sons of the nobility and gentry. Winchester maintains its unruffled place principally for geographical reasons. Eton and Westminster had always been prototypes in miniature of the Courts of Windsor and London respectively and were the "Nurseries of Government and Culture" to such an extent that they were referred to *vulgo* as the Lords and the Commons (Eton being the Commons).

But the aristocratic isolation of Eton and Windsor stole a march upon the political chaos, the decanal vagaries and the then equivalent of "ribbon development" at Georgian Westminster, whose school was irregularly patronised or neglected, so that the conscientious parent found his choice more and more predetermined. Mr. Tanner here makes an intriguing speculation about the present-day encroachment of Greater London upon the environs of a now famous Grammar School.

The illustrations (by the publishers) are particularly good.

Old Westminsters (who, incidentally, must be thankful for the dignity of their alumnal description) may be permitted a smile at page 109 and a blush for one or two figures on pages 100 and 52a, but the book remains a pleasurable necessity and Mr. Tanner is not only to be congratulated, but to be thanked.

Sport and Travel in East Africa. Compiled from the Private Diaries of H.R.H. THE PRINCE OF WALES by PATRICK R. CHALMERS. (Philip Allan. 12*s*. 6*d*.)

To be forced to spend a night, unexpectedly, in the bush, to hear a lion roar down the back of his neck, and to remember through the long hours of darkness many grim and exciting incidents from that fine book, *The Man-Eaters of Tsavo*, was not the only thrilling experience which befell the Prince of Wales during his two visits to East Africa in 1928 and 1930. But to recommend *Sport and Travel in East Africa* for the sake of its adventures would be to do a grave injustice both to the Prince of Wales and to Mr. Patrick Chalmers, on whom the main responsibility for the book has fallen. For the book, culled, very ably, from the private diaries of H.R.H. and supplemented by the aid of conversations with those who went on *safari* with the Prince, is a good account of a journey and a most excellent record of men and animals.

The story begins, since all expeditions must make a start, with the departure of the Prince of Wales and his companions from England. Perhaps this is a pity, for, although we appreciate a unity, we are, like all good adventurers, impatient of preliminaries. Once Africa is reached, and the official ceremonies are over, the main business of *safari* begins, and begins excitingly with an adventure with a single tusker elephant.

The main object of the expedition was not to win trophies and to kill, but to photograph and to observe. For those who do not know as much as they could wish about big game the pages which tell of animals in their natural surroundings will delight the most. We learn to see the elephant standing statue-still so that he is as difficult "to find as is a young plover clapped flatly on a shingle-bed"; the "bounding tawny shape" of the lion; the buffalo; the rhinoceros; the crocodile, which will spin like a top, "bringing his tremendous tail about the visitor's legs with the swish of a scythe"; and, to talk of other things, the pygmies, who do not enjoy their pipe unless it takes them by the throat and half kills them. The Prince, unlike his counterpart in fairy stories, is not always successful in his adventures, but they are mighty ones, and if he did not catch the elephant, "Pontius the Pilot," which he pursued for 70 miles on blistered feet, he was present when "a great black-maned lion lay dead, pin-cushioned with spears."

The first *safari* was interrupted by the King's illness, the interruption fortunately serving as no more than a pleasant excuse for the second. Both trips are excellently illustrated by photographs, many of them being stills from the Prince's films. Mention must likewise be made of the three maps and a series of beautiful views taken by Captain A. T. A. Ritchie.

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